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Humpback Mysteries 72 Dubai: Sudden City 94 Hummingbirds 114
Arctic Night Trek 130 Slovenia Treasure 150

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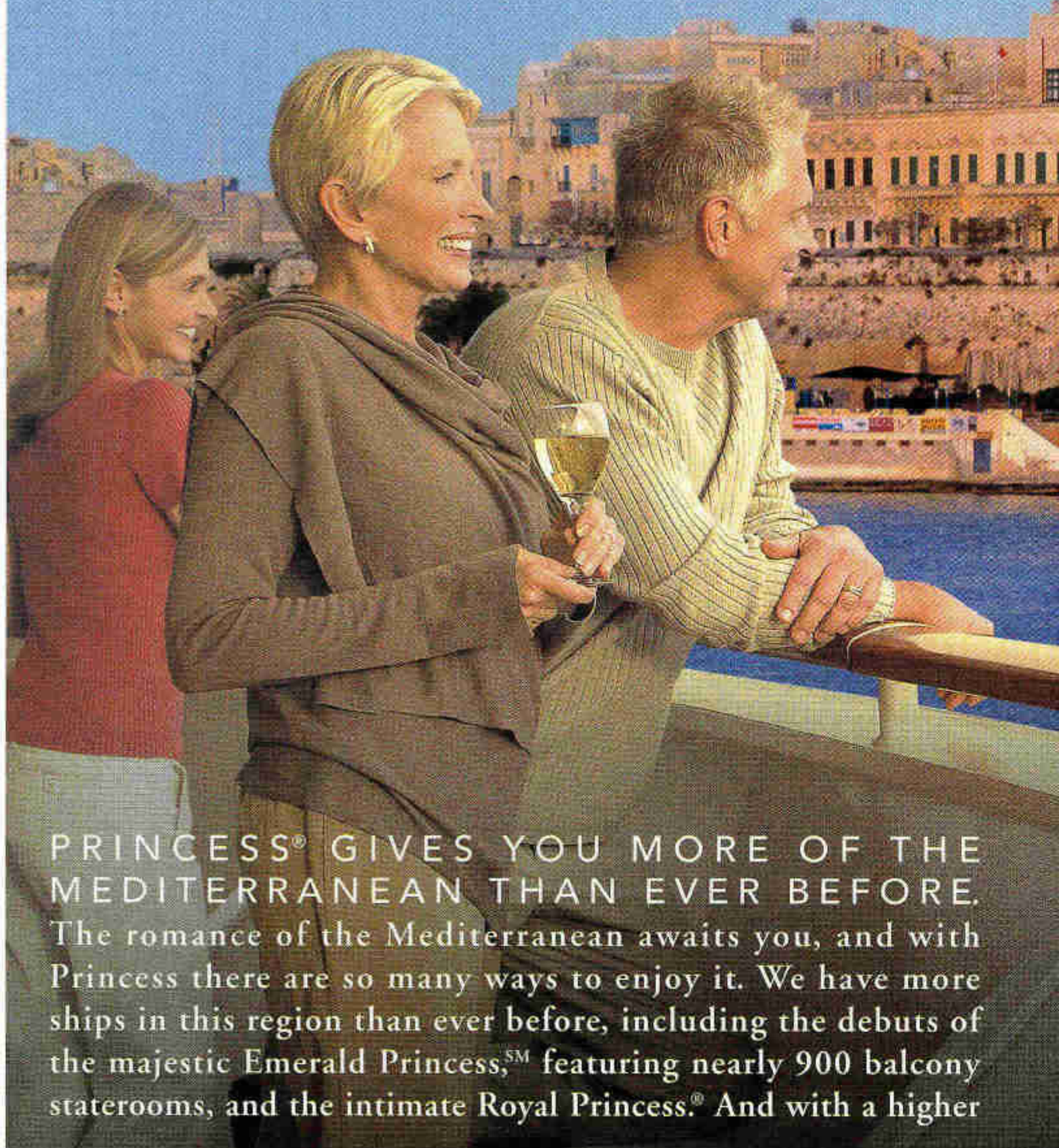

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NATIONAL GEOGRAPHIC

JANUARY 2007 • VOL. 211 • NO. 1

Two humpback whales float about 40 feet below the surface off Hawaii. Every winter, thousands of humpbacks gather here to mate and give birth. Story on page 72.

FLIP NICKLIN

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Brazil's dilemma: Allow widespread—and profitable—destruction of the rain forest to continue, or intensify conservation efforts.
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Hidden Lives of Humpbacks 72
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A River's Gifts 150
Why did Romans, Celts, and even prehistoric settlers submerge their personal belongings, from swords to dishes, in a shallow river in Slovenia?
BY CAROL KAUFMANN PHOTOGRAPHS BY ARNE HODALIČ

COVER A lone tree casts a long shadow across newly cultivated land in the former rain forest of Pará, Brazil. **PHOTO BY ALEX WEBB**

Cover printed on recycled-content paper

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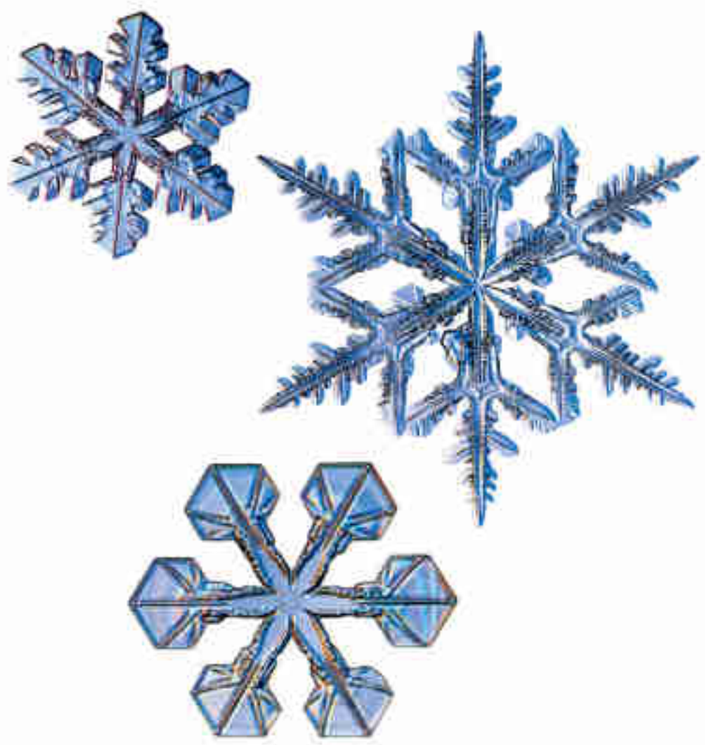

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On the Web

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Beautiful Blurs
Watch jewel-feathered hummingbirds as they sing, feed, and zip from flower to flower. One species—the scintillant—is so tiny that it can bathe in a small leaf.

Whale-watching
Get a close-up view of humpback whales engaged in a graceful behemoth ballet.

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PHOTOS (LEFT TO RIGHT): NASA; KENNETH LIBBRECHT; JOEL BERGER, WILDLIFE CONSERVATION SOCIETY

Helmet Vanga *(Euryceros prevostii)*
Size: Head and body length, 11 - 12 inches; tail, 4 inches; wingspan, 12 - 13 inches
Weight: approx. 0.2 lbs **Habitat:** Humid lowland evergreen rainforests of northeastern Madagascar
Surviving number: Estimated at 10,000 - 19,000

Photographed by Nick Garbutt

WILDLIFE AS CANON SEES IT

Meet a Madagascan mystery. Little is known about the helmet vanga, a bird that has managed to maintain a low profile despite a conspicuously large and bold blue beak. It passes its days in the middle stratum of the rainforest, often mingling with mixed flocks including other species of vanga. The sole member of its genus, it keeps to a narrow range rich in the insects and other invertebrates that sustain it. One thing that is known about the helmet vanga is that it cannot survive outside primary rainforests. So it is no mystery why populations are in peril as Madagascar's forests fall prey to the demands of agriculture and timber extraction.

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EDITOR'S NOTE

My grandfather was a teenager when he and his brothers jumped on a train in Wisconsin, headed west, and never looked back. They changed their name from Johnson to Johns to avoid confusion—there were too many men named Johnson in the logging camps where they worked. They cut trees, burned brush, started farms and families, and made new lives.

Behind my grandfather's small farm was a forest we explored together. Our adventures instilled in me a love of the outdoors and the power of observation. When I was ten, my grandfather taught me to shoot a rifle; our hikes evolved into hunting trips. Eventually I put down my rifle and picked up a camera.

George C. Johns (standing, center, in dark coat) ran an Oregon logging crew.

Whenever I photograph in a forest, I'm reminded of my grandfather, not just because of the skills he taught me, but also because of the life he led. I can't help but wonder how he reconciled his love of the forest with the fact that he cut down trees. I'm sure he would have had a thoughtful response. Perhaps he might even have become a conservationist—fighting for the trees he loved. But that is speculation, coming from a grandson who adored his grandfather.

It is not speculation to say that conserving the world's forests demands measured conversation and thoughtful action. And nowhere is there more at stake than in the great nation of Brazil. We hope our story this month helps inform the debate.

PHOTO: CLARK KINSEY

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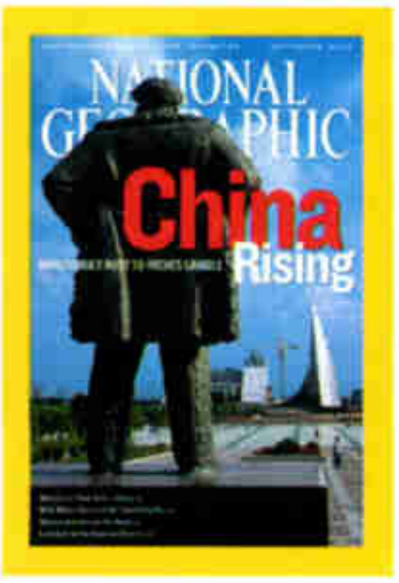
LETTERS

September 2006



"Manchurian Mandate" moved readers to write about the plight of Chinese in that region, with some contrasting the story with the one on shoes. "The Joy of Shoes" found traction too; it grabbed the most letters this month. Many readers praised the change of pace and felt it struck a balance between informative and fun.

Comment on January stories at **ngm.com**.

Manchurian Mandate

Author Brook Larmer mentioned that someone like Mengxue and her parents are "the last holdouts against the march of history." No, everyone wants and likes the benefits of progress. But in China, only the ordinary people suffer the great cost of progress. They have lost their jobs, homes, and dignity. Mengxue's parents oppose what this society does to them, not the march of history.

XIA HANGUANG
Tianjin, China

This article reinforces the economic and human issues facing China in spite of its great economic strides. It broke my heart to read about Mengxue, the daughter of Li Zhongxu and Liu Yaqin. It is difficult to imagine that a family could not afford ten dollars to send their child to a better high school.

GAIL KNOTT
Baltimore, Maryland

As a national of China, I am amused by your Americanized perspective on economic development in China's Northeast. For people like me who grew up in the area, the term "Manchuria" is quite stupid. It reveals a United States obsessed with China's history of being ruled by Euro-Americans and Japanese. To Chinese, the name "Manchuria" represents a puppet regime in the darkest

age that was created by Japanese invaders who aimed to rule China. It is not different from someone from Holland preaching to the U.S. on how to address racial hatred in "New Amsterdam."

WEN ZHANG
New York, New York

From the story's editor, Oliver Payne: We were aware of the difficulties surrounding the term Manchuria but decided to use it on the cover and sparingly in the article itself because most of our readers immediately associate it with the northeastern part of China. Throughout the article, we were careful to use the preferred Chinese term Dongbei or the geographic label Northeast.

As much as I am aware of poverty around the world, this article brought home the desperate plight of the poor of this region. I despaired for the seeming hopelessness of their situation. Then I turned the page to look upon a pair of Manolo Blahnik shoes. Could anything have been more inappropriate than to follow the story of the poor of China with this display of intolerable conspicuous consumption?

STEVE MILLER
Santa Fe, New Mexico

The Joy of Shoes

I read your interesting article about the extravagantly inventive, outrageously expensive, often impractical, but undeniably elegant torture instruments for our feet. They were created for exquisitely sophisticated, body-crunching, but soul-liberating martyrdom. I have found an escape from this foot-strangling prison—a pair of old slippers, expertly molded by years of unstinting use by my own two feet. Beauty may be in the eye

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LETTERS

of the beholder, but the pain dwells in your feet.

VYTAUTAS MATULIONIS
Cleveland Heights, Ohio

Who would think that a feature on shoes would be so interesting? It reminded me of something that happened while on a visit to Germany. My two sons and I went to Dachau. In the museum, there was a huge picture of shoes piled up into a pyramid in a large room. That picture remains with me today. Those empty shoes had so much to tell as to what happened to their owners.

RICHARD HANDSCHUCH
Seaside Park, New Jersey

In your article on shoes, Manolo Blahnik is quoted as saying, "I am embarrassed. People are dying and I do these frivolous things." I wonder how your editors feel? This glib, facile story was unworthy of your magazine.

PETER SPURGING
Seattle, Washington

I very much enjoyed the article. It seems that the mundane, day-to-day artifacts in our lives sometimes have significant stories to tell.

CHRISTOPHER IMHOF
Broomfield, Colorado

Your historical perspective on shoes omitted the best darn piece of high-stepping paraphernalia ever—the penny loafer. In what other shoe can you conveniently wedge in coins for that all-important one- and two-cent tax awaiting you at some registers?

JEROME CHANEY
Martinez, California

Cathy Newman informs us that Neil Armstrong's boots and nine other pairs are still on the lunar surface. So what's the story behind the two missing pairs of the 12 men who walked on the moon?

KURT ROSADO
Ocean Shores, Washington

Weight allowance on the lunar missions: Ten of the twelve astronauts left their boots on the moon in order to bring back more lunar rocks to Earth. But on Apollo 17, the last moon mission, Harrison Schmitt and Eugene Cernan sacrificed some rocks so they could return their boots to NASA for examination.

Killer Pride

What is the point of the article? Is it entertaining or educational to see animals torturing others to death? Isn't there enough cruelty in the world that is dangled in front of our noses every day without also seeing it in vivid color in the animal kingdom?

BILL KOHLER
Endicott, New York

Kudos for the article by the Joubert team. Superb photos and text. I suspect that the Jouberts became members of the pride during their study—keeping a discreet distance, but close enough for their remarkable photos. I am sure that I am one of many who appreciate their beautifully illustrated and written fieldwork.

JIM SECREST
Mariposa, California

Corrections, Clarifications

September 2006:
Manchurian Mandate The picture on pages 66-7 shows an oil pump, not an oil derrick.

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Fresh Start For the January Your Shot, we asked readers to send in photographs on the theme of "Something New." The pair of pictures chosen—a backlit businessman starting his day and a fresh look at a bird in the snow—were selected from thousands. Submit one of your own favorite photos—on any topic—for possible publication in an upcoming issue of NATIONAL GEOGRAPHIC. For guidelines and a submission form, and to see more readers' photography, go to *ngm.com/yourshot*.

Graham De Lacy Johannesburg, South Africa

ABOVE Though busy working on a television shoot one cold morning at the Krugersdorp train station outside Johannesburg, Graham De Lacy—a freelance art director—caught this commuter emerging from the manufactured mists of his production's smoke machines.

RIGHT "I had some trail mix, and he had the will," says Jonathan Ingraham of the hungry Steller's jay he photographed during a snowshoe hike through Rocky Mountain National Park. "Every chance I get to go somewhere with my camera," he says, "I do it."

Jonathan Ingraham Fort Collins, Colorado

While Utah has some lovely ski trails, we go for the airbags.

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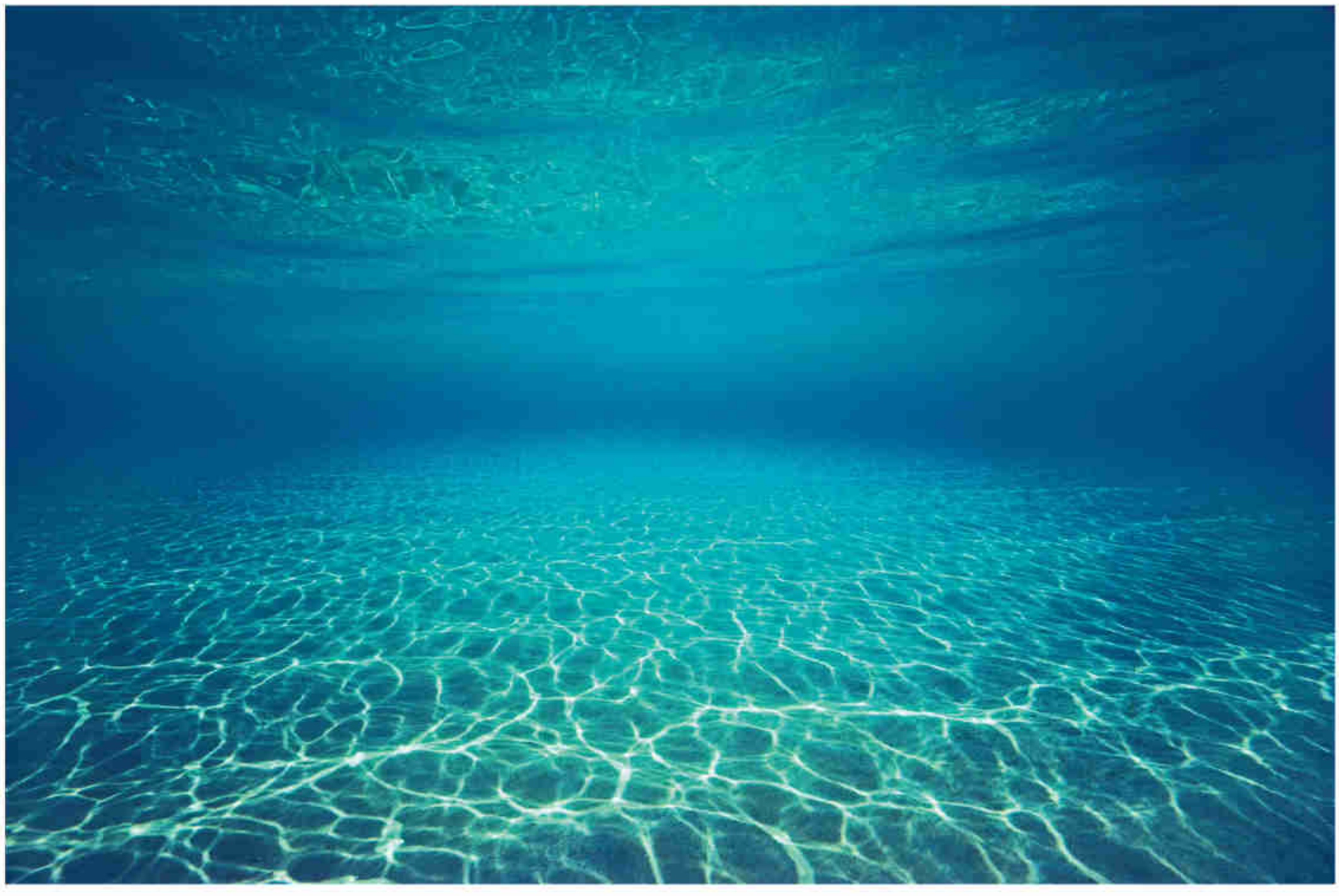

Before the Sinai's development, says David Doubilet, "every coastal indentation was a unique underwater universe."

David Doubilet shot his first GEOGRAPHIC story in the Red Sea—"The Red Sea's Gardens of Eels"—for the November 1972 issue.

Desert Sea It is an elemental picture—water and light. While some people ponder it like a painting, others say simply, "Where are the fish?" My usual mental reply to the latter is, the fish left, followed by a more audible explanation of what makes this image work for me: It marks a time and place in my life in the sea.

I made this picture in 1981 at Marsa al Muqabilah, on the Sinai coast. From 1967 to 1982, the Sinai Peninsula was under the administration of Israel. The entire coastline along the northeast arm of the Red Sea was a largely empty beach. I first traveled there in the winter of 1971, and the place drew me back like a magnet. Over the next 15 years I returned to shoot eight stories for GEOGRAPHIC.

In 1982 the Sinai was returned to Egypt. The lonely coast became a Sinai Riviera with hotels and dive centers every few miles. Now it's a mini-Las Vegas with scuba diving instead of gambling.

Of all the complex scenes I captured on film before that happened, it is this simple photo that conjures my strongest emotions. Clear blue water is one of the great gifts on our planet, and the waters of the Red Sea are often a joyous glowing blue. This image recalls a time when the Sinai coast was an underwater Camelot. This calm, perfect stage of light opened dives like the raising of a curtain in a theater.

Underwater Adventure Join photographer David Doubilet in Africa's Okavango Delta at **ngm.com/0412/feature3**.

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VISIONS OF EARTH

Virunga National Park, Democratic Republic of the Congo This incandescent lava lake seethes within Nyiragongo volcano just ten miles from Goma, a city of half a million people.

PHOTO: OLIVIER GRUNEWALD

Quebec Province, Canada Wings outstretched, talons flared, and ears tuned to the faintest scrabblings of a rodent hidden under winter's white carpet, a snowy owl prepares to pounce.

PHOTO: VINCENT MUNIER

Pyongyang, North Korea Thousands of synchronized performers swirl through the Arirang Festival, a two-month-long celebration of national pride.

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PHOTO: CHRISTOPHER MORRIS, VII

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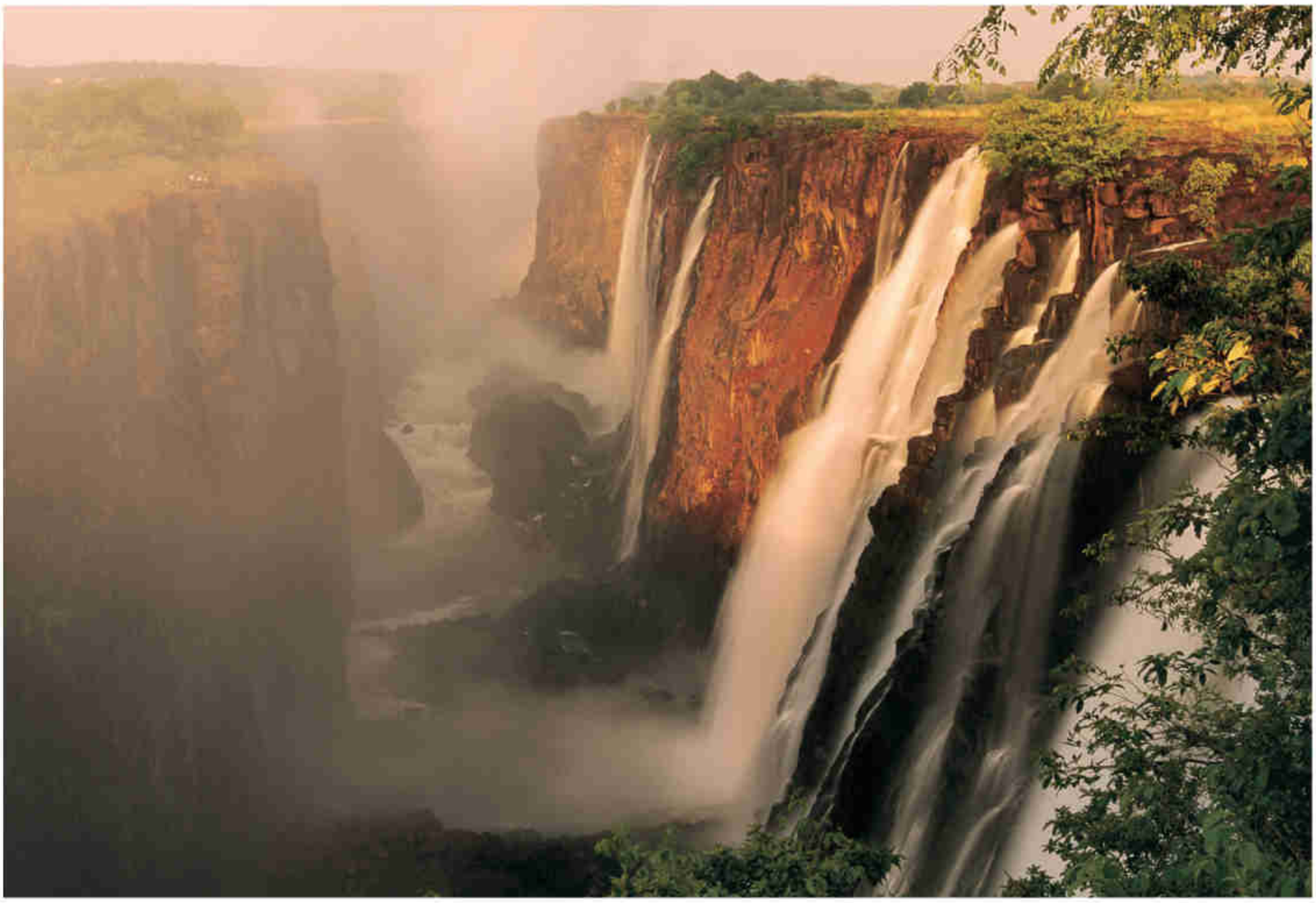
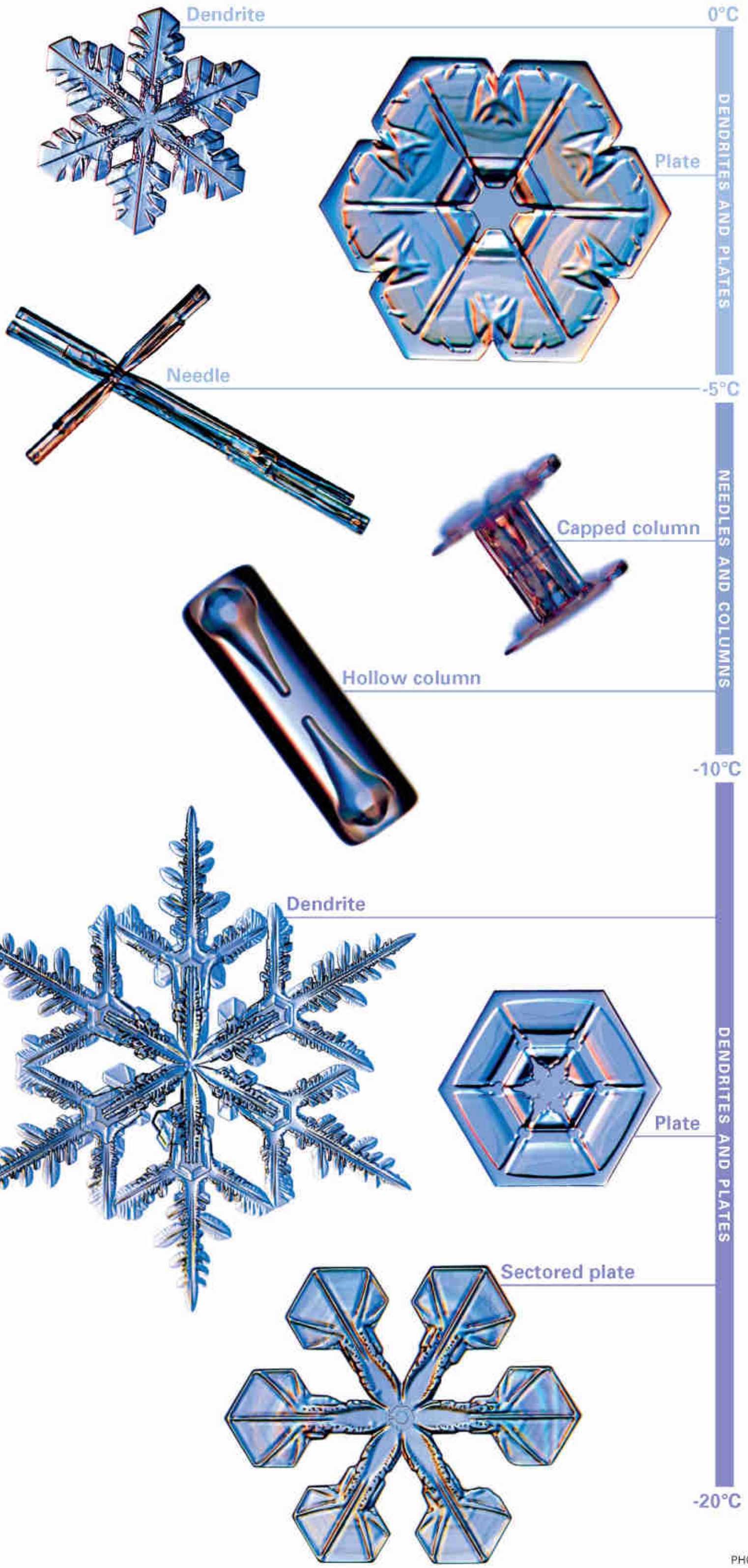


Major elephant routes cross a site slated for development as a golf resort.

Showdown at Victoria Falls Just before the Zambezi River makes its famous plunge (above), lies a small, undeveloped stretch of Zambia's Mosi-Oa-Tunya National Park. It's a crucial elephant crossing and the sole riverfront spot in the park that people can enjoy without paying a fee. South African developer Legacy Holdings Zambia, with the support of the Zambia Wildlife Authority, has different plans for the site: two hotels, 400 villas, and a golf course. In a nod to wildlife, the plans include an elephant right-of-way flanking the Maramba River. Critics find this laughable. "Elephant corridors have never worked anywhere," says conservationist Mike Musgrave.

Since the proposal became public last summer, Zambians ranging from local government officials to a bike-tour guide have rallied in opposition. Area residents welcome development, just not so close to the falls that it jeopardizes the park's status as a UNESCO World Heritage site. They hope grassroots pressure and a legal challenge will save the park's last riverfront open space. "Even 30 years ago Victoria Falls was overdeveloped," says Ian Manning, a former park warden. "This would be a disaster." *—Karen E. Lange*

PHOTO: STEPHEN ROBINSON



The Mystery of Snowflakes

That no two snowflakes look exactly alike is fairly common knowledge. Less well known is that a snowflake's shape depends on the temperature at which it forms. When the mercury hovers between –1°C (30°F) and –3°C (27°F), snowflakes crystallize as plates and dendrites. At about –5°C, needles and hollow columns appear. At still colder temperatures, the flake design returns to dendrites and plates. And when snowflakes start forming into columns at around –5°C but then encounter cooler or warmer temperatures, the crystals end up as capped columns —part column, part plate.

What no one knows is why temperature affects crystal formation. Kenneth Libbrecht, chair of the physics department at the California Institute of Technology, is trying to solve the mystery by studying thousands of flakes, both in the wild, such as those shown here, which he photographed in Ontario, Michigan, and Alaska, and in his lab, where he grows snowflakes under controlled conditions. By comparing snowflake development with theories of crystal growth, he may unlock the secret of how flakes take shape.

According to Libbrecht, the shifting of snowflake shapes may even hold clues to some bigger questions of global warming. "Nature is one unstable system heaped on another," he says. "Knowing where the tipping points are is key to learning if global climate has similar thresholds where sudden changes may occur." —*Michael Klesius*

PHOTOS: KENNETH LIBBRECHT. SNOWFLAKE SIZES NOT TO SCALE

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Pronghorns bound through snow in Wyoming's upper Green River Basin.

Losing Ground Pronghorn antelope run faster than any animal except the cheetah, and they make the longest migration—up to 350 miles round-trip—of any land mammal in the U.S. But they can't outpace human development. For millennia, pronghorns followed eight routes in Idaho, Montana, and Wyoming to their summer ranges in the Yellowstone and Teton highlands. Six of these routes are now blocked by roads, farms, reservoirs, and suburban sprawl.

Their only path south of the Tetons narrows to a few hundred feet, about a sixteenth of its average width. "The southern path is an artery for the lifeblood of Grand Teton National Park," says Steve Cain, a biologist with the National Park Service. "It's part of a predator-prey system unrivaled in the U.S. outside Alaska," sustaining coyotes, wolves, mountain lions, and grizzlies.

Cain and his colleagues are pushing for government protection of the remaining pronghorn routes. They also recommend that any natural gas fields be tapped diagonally from outside the route. "This is one of the last world-class examples of long-distance mammal migration," Cain says. "If we destroy it for the sake of human convenience, we'll regret it for sure." *—Michael Klesius*

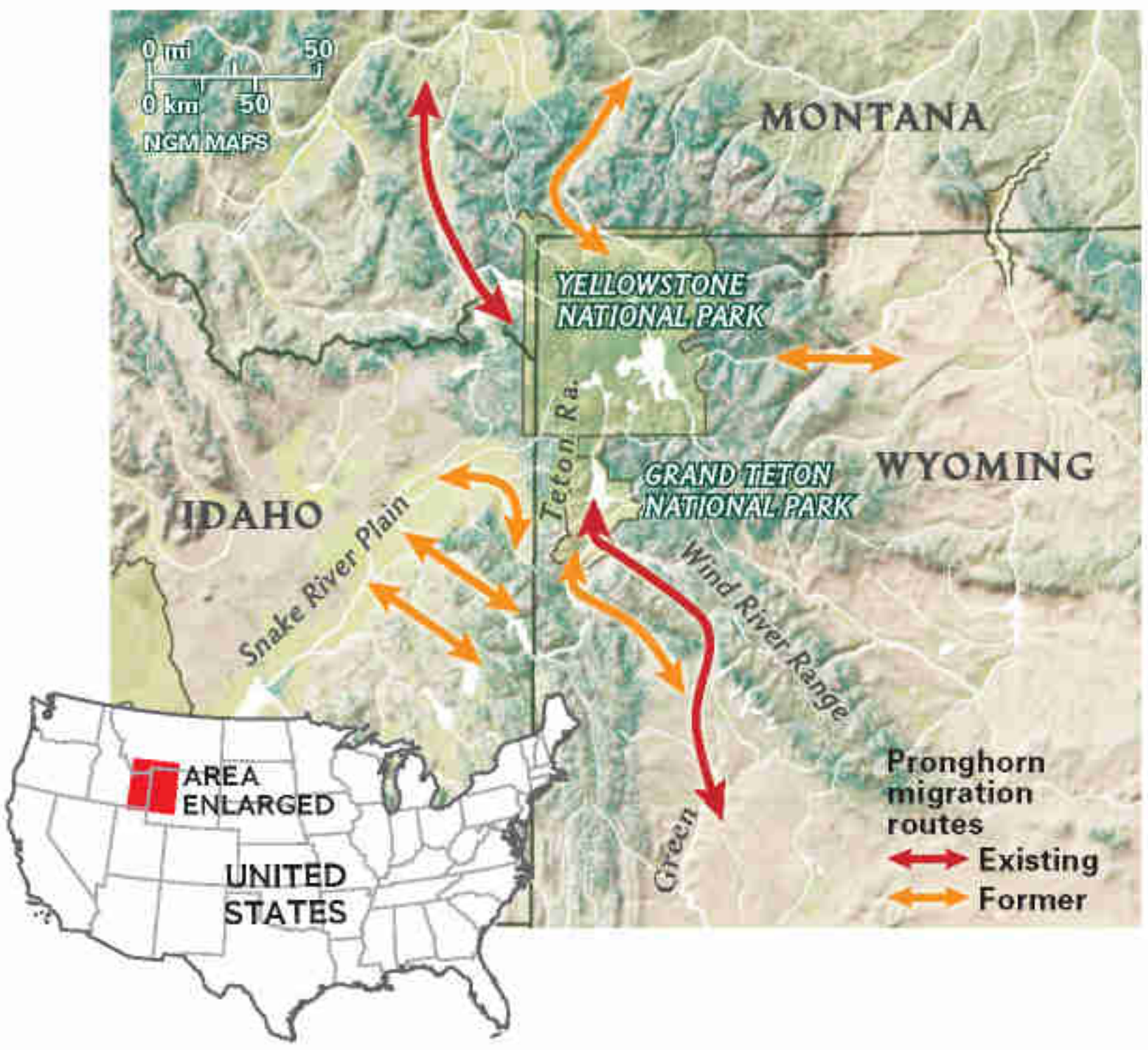
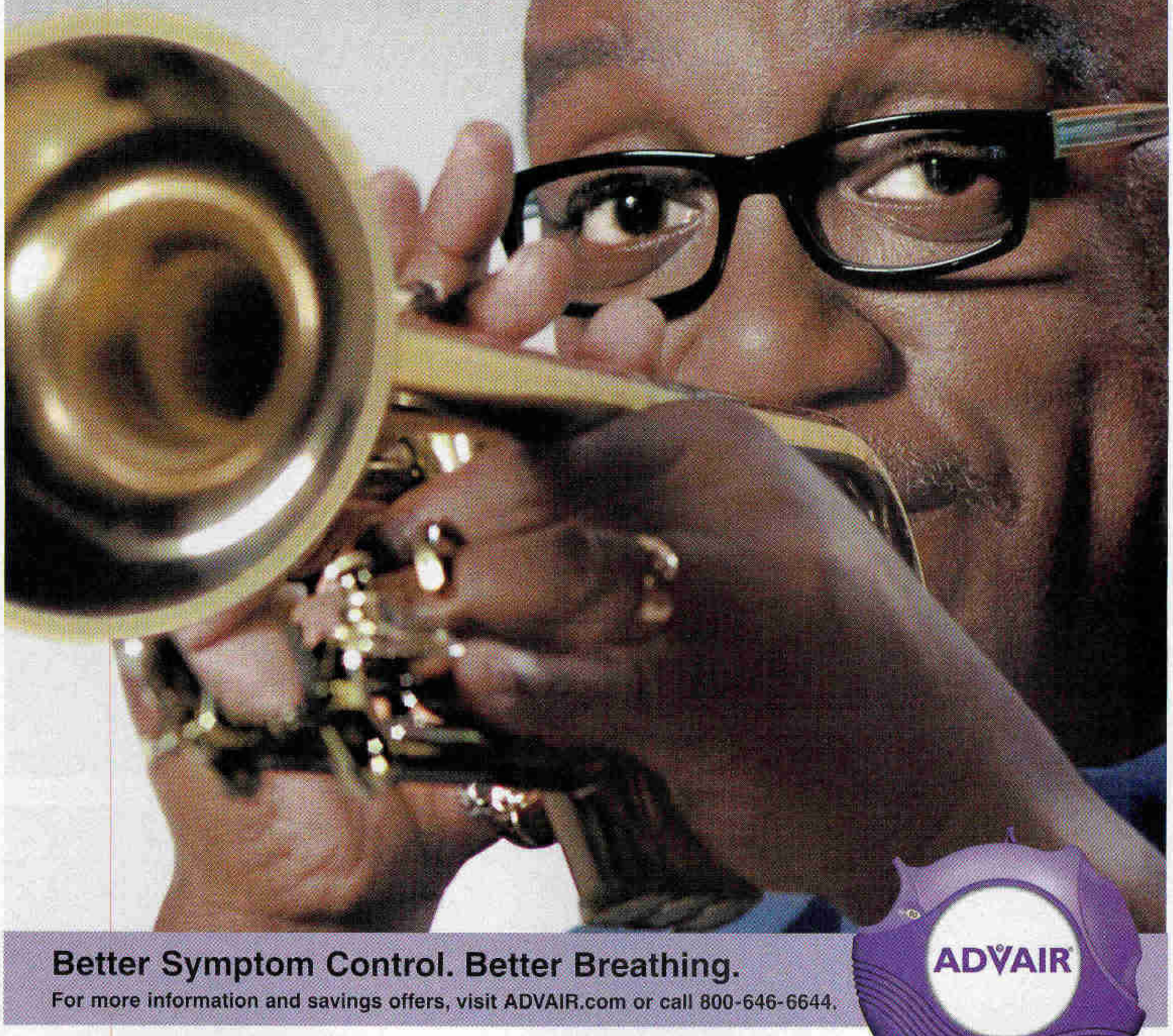


PHOTO: JOEL BERGER, WILDLIFE CONSERVATION SOCIETY

Fewer asthma symptoms. Better breathing.* I like that tune.

ADVAIR treats the two main causes of my asthma symptoms—airway constriction and inflammation. That's why it helps me breathe better. My doctor put me on ADVAIR because I was still having symptoms even though I was taking a controller medicine. Talk to your doctor and find out if ADVAIR is right for you.



Better Symptom Control. Better Breathing.

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ADVAIR DISKUS 100/50
(fluticasone propionate 100 mcg and salmeterol 50 mcg inhalation powder)

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Important information about ADVAIR. Prescription ADVAIR won't replace fast-acting inhalers for sudden symptoms and should not be taken more than twice a day. ADVAIR contains salmeterol. In patients with asthma, medicines like salmeterol may increase the chance of asthma-related death. So ADVAIR is not for people whose asthma is well controlled on another controller medicine. Talk to your doctor about the risks and benefits of treating your asthma with ADVAIR. If you are taking ADVAIR, see your doctor if your asthma does not improve. Tell your doctor if you have a heart condition or high blood pressure. Some people may experience increased blood pressure, heart rate, or changes in heart rhythm. ADVAIR is for patients 4 years and older. For patients 4 to 11 years old, ADVAIR 100/50 is for those who have asthma symptoms while on an inhaled corticosteroid.

*People ages 12 years and older taking ADVAIR 100/50 experienced improved lung function and asthma symptom scores, and a reduction in fast-acting inhaler use, compared with people taking either fluticasone propionate 100 mcg or salmeterol 50 mcg (inhalation powders) alone.

Please see important information about ADVAIR on the next page.

Results may vary.

Information about ADVAIR DISKUS

ADVAIR DISKUS® 100/50, 250/50, 500/50

(fluticasone propionate 100, 250, 500 mcg and salmeterol 50 mcg inhalation powder)

What is the most important information I should know about ADVAIR DISKUS?
In patients with asthma, long-acting beta$_2$-agonist medicines such as salmeterol (one of the medications in ADVAIR®) may increase the chance of death from asthma problems. In a large asthma study, more patients who used salmeterol died from asthma problems compared with patients who did not use salmeterol. So ADVAIR is not for patients whose asthma is well controlled on another asthma controller medicine such as low- to medium-dose inhaled corticosteroids or only need a fast-acting inhaler once in a while. Talk with your doctor about this risk and the benefits of treating your asthma with ADVAIR.

ADVAIR should not be used to treat a severe attack of asthma or chronic obstructive pulmonary disease (COPD) requiring emergency medical treatment.

ADVAIR should not be used to relieve sudden symptoms or sudden breathing problems. Always have a fast-acting inhaler with you to treat sudden breathing difficulty. If you do not have a fast-acting inhaler, contact your doctor to have one prescribed for you.

What is ADVAIR DISKUS?
There are two medicines in ADVAIR: Fluticasone propionate, an inhaled anti-inflammatory belonging to a group of medicines commonly referred to as corticosteroids; and salmeterol, a long-acting, inhaled bronchodilator belonging to a group of medicines commonly referred to as beta$_2$-agonists. There are 3 strengths of ADVAIR: 100/50, 250/50, 500/50.

For Asthma
- ADVAIR is approved for the maintenance treatment of asthma in patients 4 years of age and older. ADVAIR should only be used if your doctor decides that another asthma controller medicine alone does not control your asthma or that you need 2 asthma controller medications.
- The strength of ADVAIR approved for patients ages 4 to 11 years who experience symptoms on an inhaled corticosteroid is ADVAIR DISKUS 100/50. All 3 strengths are approved for patients with asthma ages 12 years and older.

For COPD associated with chronic bronchitis
ADVAIR 250/50 is the only approved dose for the maintenance treatment of airflow obstruction in patients with COPD associated with chronic bronchitis. The benefit of using ADVAIR for longer than 6 months has not been evaluated. The way anti-inflammatories work in the treatment of COPD is not well defined.

Who should not take ADVAIR DISKUS?
You should not start ADVAIR if your asthma is becoming significantly or rapidly worse, which can be life threatening. Serious respiratory events, including death, have been reported in patients who started taking salmeterol in this situation, although it is not possible to tell whether salmeterol contributed to these events. This may also occur in patients with less severe asthma.

You should not take ADVAIR if you have had an allergic reaction to it or any of its components (salmeterol, fluticasone propionate, or lactose). Tell your doctor if you are allergic to ADVAIR, any other medications, or food products. If you experience an allergic reaction after taking ADVAIR, stop using ADVAIR immediately and contact your doctor. Allergic reactions are when you experience one or more of the following: choking; breathing problems; swelling of the face, mouth and/or tongue; rash; hives; itching; or welts on the skin.

Tell your doctor about the following:
- If you are using your fast-acting inhaler more often or using more doses than you normally do (e.g., 4 or more inhalations of your fast-acting inhaler for 2 or more days in a row or a whole canister of your fast-acting inhaler in 8 weeks' time), it could be a sign that your asthma is getting worse. If this occurs, tell your doctor immediately.
- If you have been using your fast-acting inhaler regularly (e.g., four times a day). Your doctor may tell you to stop the regular use of these medications.
- If your peak flow meter results decrease. Your doctor will tell you the numbers that are right for you.
- If you have asthma and your symptoms do not improve after using ADVAIR regularly for 1 week.
- If you have been on an oral steroid, like prednisone, and are now using ADVAIR. You should be very careful as you may be less able to heal after surgery, infection, or serious injury. It takes a number of months for the body to recover its ability to make its own steroid hormones after use of oral steroids. Switching from an oral steroid may also unmask a condition previously suppressed by the oral steroid such as allergies, conjunctivitis, eczema, arthritis, and eosinophilic conditions. Symptoms of an eosinophilic condition can include rash, worsening breathing problems, heart complications, and/or feeling of "pins and needles" or numbness in the arms and legs. Talk to your doctor immediately if you experience any of these symptoms.
- Sometimes patients experience unexpected bronchospasm right after taking ADVAIR. This condition can be life threatening and if it occurs, you should immediately stop using ADVAIR and seek immediate medical attention.
- If you have any type of heart disease such as coronary artery disease, irregular heart beat or high blood pressure, ADVAIR should be used with caution. Be sure to talk with your doctor about your condition because salmeterol, one of the components of ADVAIR, may affect the heart by increasing heart rate and blood pressure. It may cause symptoms such as heart fluttering, chest pain, rapid heart rate, tremor, or nervousness.
- If you have seizures, overactive thyroid gland, liver problems, or are sensitive to certain medications for breathing.
- If your breathing problems get worse over time or if your fast-acting inhaler does not work as well for you while using ADVAIR. If your breathing problems worsen quickly, get emergency medical care.
- If you have been exposed to or currently have chickenpox or measles or if you have an immune system problem. Patients using medications that weaken the immune system are more likely to get infections than healthy individuals. ADVAIR contains a corticosteroid (fluticasone propionate) which may weaken the immune system. Infections like chickenpox and measles, for example, can be very serious or even fatal in susceptible patients using corticosteroids.

How should I take ADVAIR DISKUS?
ADVAIR should be used 1 inhalation, twice a day (morning and evening). ADVAIR should never be taken more than 1 inhalation twice a day. The full benefit of taking ADVAIR may take 1 week or longer.

If you miss a dose of ADVAIR, just skip that dose. Take your next dose at your usual time. Do not take two doses at one time.

Do not stop using ADVAIR unless told to do so by your doctor because your symptoms might get worse.

Do not change or stop any of your medicines used to control or treat your breathing problems. Your doctor will adjust your medicines as needed.

When using ADVAIR, remember:
- Never breathe into or take the DISKUS® apart.
- Always use the DISKUS in a level position.
- After each inhalation, rinse your mouth with water without swallowing.
- Never wash any part of the DISKUS. Always keep it in a dry place.
- Never take an extra dose, even if you feel you did not receive a dose.
- Discard 1 month after removal from the foil overwrap.
- Do not use ADVAIR with a spacer device.

Children should use ADVAIR with an adult's help as instructed by the child's doctor.

Can I take ADVAIR DISKUS with other medications?
Tell your doctor about all the medications you take, including prescription and nonprescription medications, vitamins, and herbal supplements.

If you are taking ADVAIR, you should not take SEREVENT® DISKUS or Foradil® Aerolizer® for any reason.

If you take ritonavir (an HIV medication), tell your doctor. Ritonavir may interact with ADVAIR and could cause serious side effects. The anti-HIV medicines Norvir® Soft Gelatin Capsules, Norvir Oral Solution, and Kaletra® contain ritonavir.

No formal drug interaction studies have been performed with ADVAIR.

In clinical studies, there were no differences in effects on the heart when ADVAIR was taken with varying amounts of albuterol. The effect of using ADVAIR in patients with asthma while taking more than 9 puffs a day of albuterol has not been studied.

ADVAIR should be used with extreme caution during and up to 2 weeks after treatment with monoamine oxidase (MAO) inhibitors or tricyclic antidepressants since these medications can cause ADVAIR to have an even greater effect on the circulatory system.

ADVAIR should be used with caution in people who are taking ketoconazole (an antifungus medication) or other drugs broken down by the body in a similar way. These medications can cause ADVAIR to have greater steroid side effects.

Generally, people with asthma should not take beta-blockers because they counteract the effects of beta$_2$-agonists and may also cause severe bronchospasm. However, in some cases, for instance, following a heart attack, selective beta-blockers may still be used if there is no acceptable alternative.

The ECG changes and/or low blood potassium that may occur with some diuretics may be made worse by ADVAIR, especially at higher-than-recommended doses. Caution should be used when these drugs are used together.

In clinical studies, there was no difference in side effects when ADVAIR was taken with methylxanthines (e.g., theophylline) or with FLONASE®.

What are other important safety considerations with ADVAIR DISKUS?
Osteoporosis: Long-term use of inhaled corticosteroids may result in bone loss (osteoporosis). Patients who are at risk for increased bone loss (tobacco use, advanced age, inactive lifestyle, poor nutrition, family history of osteoporosis, or long-term use of drugs such as corticosteroids) may have a greater risk with ADVAIR. If you have risk factors for bone loss, you should talk to your doctor about ways to reduce your risk and whether you should have your bone density evaluated.

Glaucoma and cataracts: Glaucoma, increased pressure in the eyes, and cataracts have been reported with the use of inhaled steroids, including fluticasone propionate, a medicine contained in ADVAIR. Regular eye examinations should be considered if you are taking ADVAIR.

Lower respiratory tract infection: Lower respiratory tract infections, including pneumonia, have been reported with the use of inhaled corticosteroids, including ADVAIR.

Blood sugar: Salmeterol may affect blood sugar and/or cause low blood potassium in some patients, which could lead to a side effect like an irregular heart rate. Significant changes in blood sugar and blood potassium were seen infrequently in clinical studies with ADVAIR.

Growth: Inhaled steroids may cause a reduction in growth velocity in children and adolescents.

Steroids: Taking steroids can affect your body's ability to make its own steroid hormones, which are needed during infections and times of severe stress to your body, such as an operation. These effects can sometimes be seen with inhaled steroids (but it is more common with oral steroids), especially when taken at higher-than-recommended doses over a long period of time. In some cases, these effects may be severe. Inhaled steroids often help control symptoms with less side effects than oral steroids.

Yeast infections: Patients taking ADVAIR may develop yeast infections of the mouth and/or throat ("thrush") that should be treated by their doctor.

Tuberculosis or other untreated infections: ADVAIR should be used with caution, if at all, in patients with tuberculosis, herpes infections of the eye, or other untreated infections.

What are the other possible side effects of ADVAIR DISKUS?
ADVAIR may produce side effects in some patients. In clinical studies, the most common side effects with ADVAIR included:

- Respiratory infections
- Throat irritation
- Hoarseness
- Sinus infection
- Yeast infection of the mouth
- Bronchitis
- Cough
- Headaches
- Nausea and vomiting
- Diarrhea
- Musculoskeletal pain
- Dizziness
- Fever
- Ear, nose, and throat infections
- Nosebleed

Tell your doctor about any side effect that bothers you or that does not go away. These are not all the side effects with ADVAIR. Ask your doctor or pharmacist for more information.

What if I am pregnant, planning to become pregnant, or nursing?
Talk to your doctor about the benefits and risks of using ADVAIR during pregnancy, labor, or if you are nursing. There have been no studies of ADVAIR used during pregnancy, labor, or in nursing women. Salmeterol is known to interfere with labor contractions. It is not known whether ADVAIR is excreted in breast milk, but other corticosteroids have been detected in human breast milk. Fluticasone propionate, like other corticosteroids, has been associated with birth defects in animals (e.g., cleft palate and fetal death). Salmeterol showed no effect on fertility in rats at 180 times the maximum recommended daily dose.

What other important tests were conducted with ADVAIR?
There is no evidence of enhanced toxicity with ADVAIR compared with the components administered separately. In animal studies with doses much higher than those used in humans, salmeterol was associated with uterine tumors. Your healthcare professional can tell you more about how drugs are tested on animals and what the results of these tests may mean to your safety.

For more information on ADVAIR DISKUS
This page is only a brief summary of important information about ADVAIR DISKUS. For more information, talk to your doctor. You can also visit www.ADVAIR.com or call 1-888-825-5249. Patients receiving ADVAIR DISKUS should read the medication guide provided by the pharmacist with the prescription.

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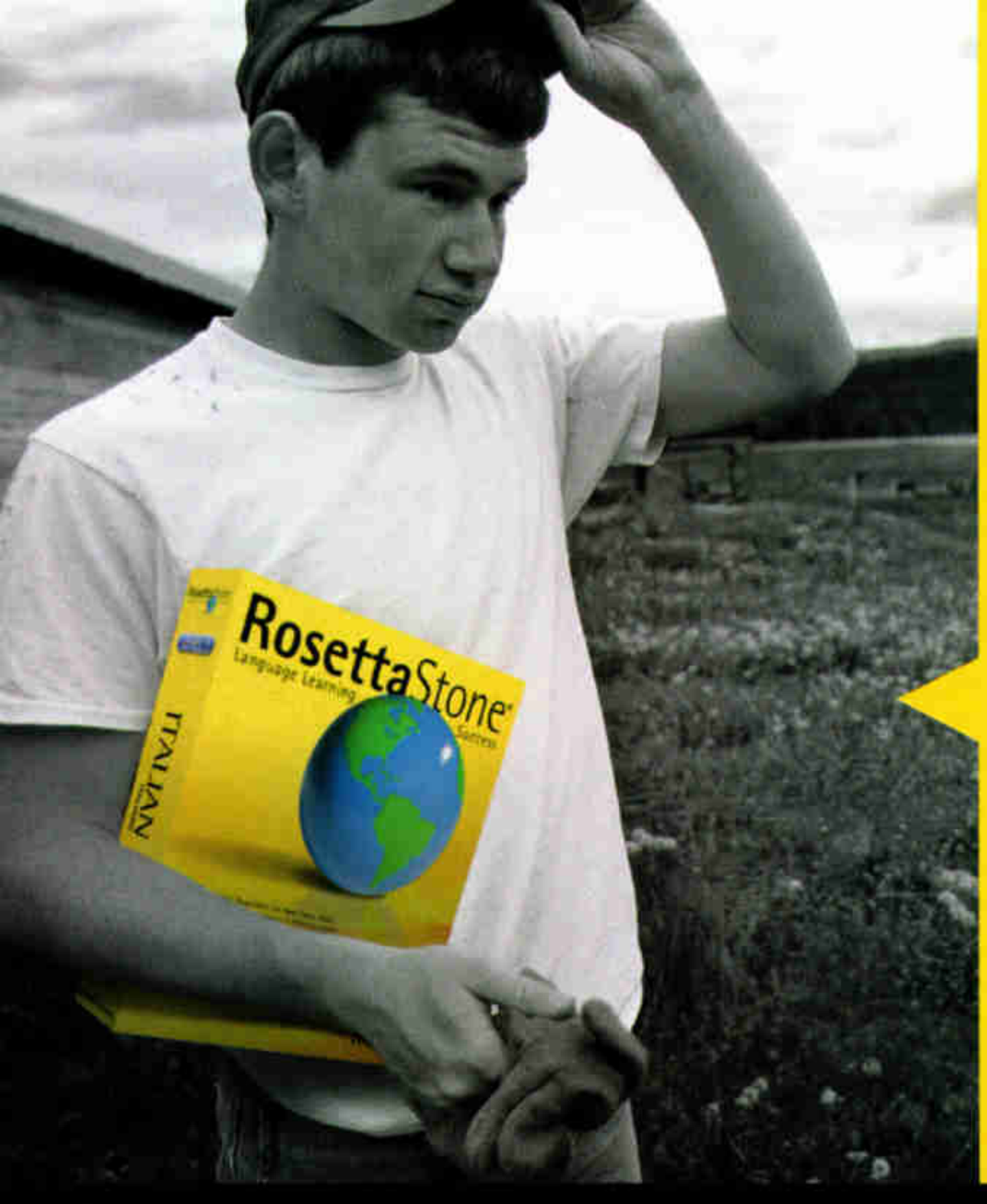

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What's in a Name

TOP BABY NAMES 2005

Jacob	1	Emily
Michael	2	Emma
Joshua	3	Madison
Matthew	4	Abigail
Ethan	5	Olivia
Andrew	6	Isabella
Daniel	7	Hannah
Anthony	8	Samantha
Christopher	9	Ava
Joseph	10	Ashley

TOP BABY NAMES OVER THE DECADES

Michael	1995	Jessica
Michael	1985	Jessica
Michael	1975	Jennifer
Michael	1965	Lisa
Michael	1955	Mary
James	1945	Mary
Robert	1935	Mary
Robert	1925	Mary
James	1915	Linda
John	1905	Mary

Emily, the top name for girls born in the U.S. in 2005, and D'Brickashaw, the first name of a rookie for football's New York Jets, may seem wildly dissimilar, but together they capture the zeitgeist. We're a nation of "lockstep individualists," notes Laura Wattenberg, an author who tracks naming trends. "Everyone is determined to be different, but we all have the same taste," she says. These days, that taste leans toward names with vowels airing out the consonants rather than harder sounding appellations like Gertrude, an 1890s hit. The quest for distinctive names also means a reduced market share for even the hottest monikers. Nearly 4.5 percent of girls born in 1945 were Marys. In 2005, little Emilys took only 1.2 percent of the pool. —*Siobhan Roth*

SOURCE: SOCIAL SECURITY ADMINISTRATION. PHOTO: FIREFLY PRODUCTIONS/CORBIS

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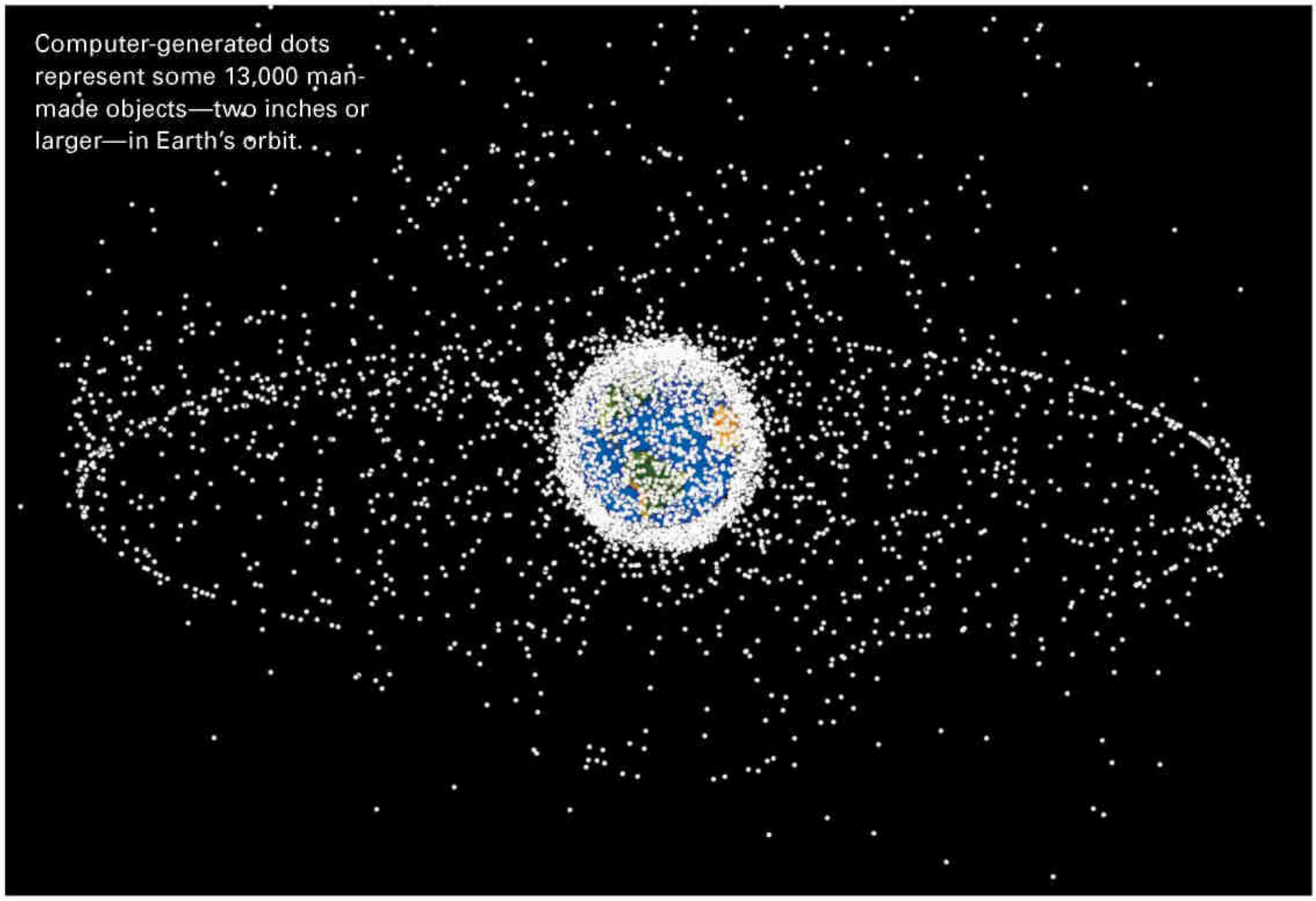
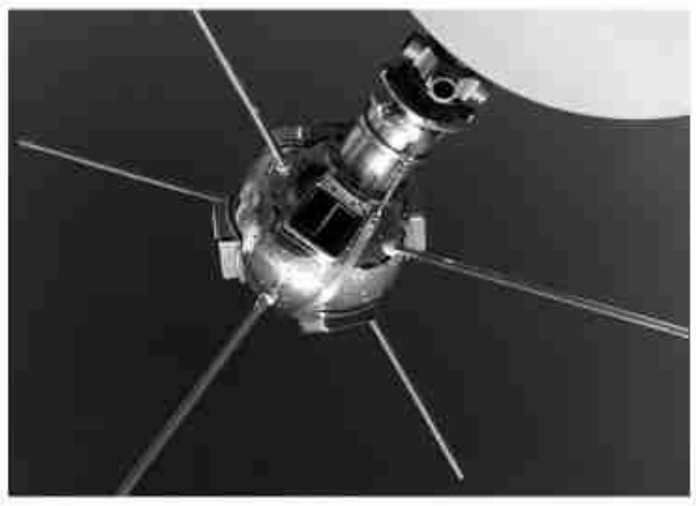
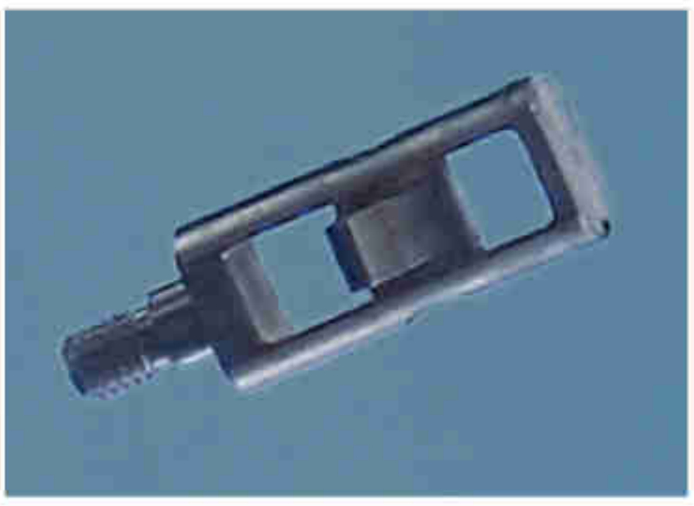
SPACE







Space Trash and Treasure Even a tiny paint flake left floating in orbit can pit the window of a space shuttle traveling 17,500 miles an hour. To avoid catastrophic collisions, the Department of Defense tracks pieces of orbiting space junk larger than two inches. Debris orbiting relatively close to Earth, such as a glove that drifted away in 1965 from Edward White (center) or an eyebolt (right) shaken loose from a solar panel on a Russian spacecraft in 2004, quickly burn up in the atmosphere. Items in higher orbit remain aloft for generations: The Vanguard 1 satellite (left) will fly for centuries. Space agencies are pondering ways to sweep such junk out of the path of collision. Meanwhile, Australian archaeologist Alice Gorman is lobbying for the creation of an international treaty that would designate certain satellites, such as the Vanguard 1, as treasures of cultural heritage. One day, she says, they may even beckon space tourists. *—Michael Klesius*

Not Functioning, but Still Orbiting

- **Vanguard 1** Launched March 17, 1958; the oldest man-made object in orbit
- **Syncom 3** The first geostationary satellite; launched August 19, 1964
- **Astérix 1** France's first satellite; launched November 26, 1965

IMAGE AND PHOTOS: NASA

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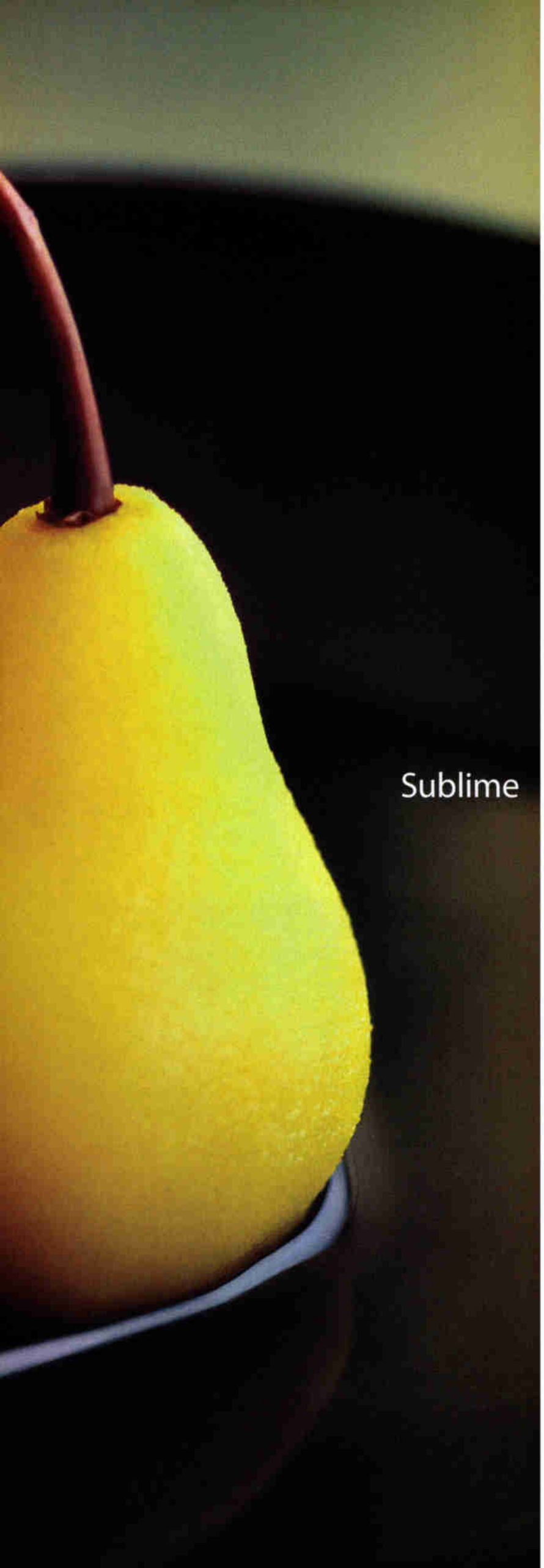

A Fossil's New Life Long ago, when rhinoceros herds grazed in the mountain valleys of what is now northwestern Spain, a rhino calf wandered into a cave and died. Fast-forward some 90,000 years. In 1970, British cavers found the creature's fossil and assumed it was the remains of a donkey. Spanish experts later proclaimed it a prehistoric bear and tried to move it to Madrid. But the area's residents weren't about to give up such a rare find, especially if it might attract tourists. "Long live the bear!" became the rallying cry of their successful campaign to keep it. Then, when local farmers showed a photo of the fossil to paleontologist Ana Pinto Llona in the year 2000, she set the record straight—their bear was a rhino. But what kind? By scraping away stone to see the original shape of a tooth, Pinto Llona and her colleagues made an astonishing discovery: The cave called La Peruyal holds what may be the only known intact juvenile skeleton of the extinct narrow-nosed rhinoceros, *Stephanorhinus hemitoechus.* "The poor thing was just 18 months old," says Pinto Llona. An interpretative center with a replica of the fossil (above) is now being developed near the cave. *—A. R. Williams*

A baby rhino (drawing below) died after straying into a cave. Its five-foot-long fossil has been replicated in fiberglass (above).

ART: MAURICIO ANTON. PHOTO: ARNAUD SPANNI; REPLICA: ISABEL PELLEJERO AND SANDRA VAL, INSTITUT DE PALEONTOLOGIA M. CRUSAFONT

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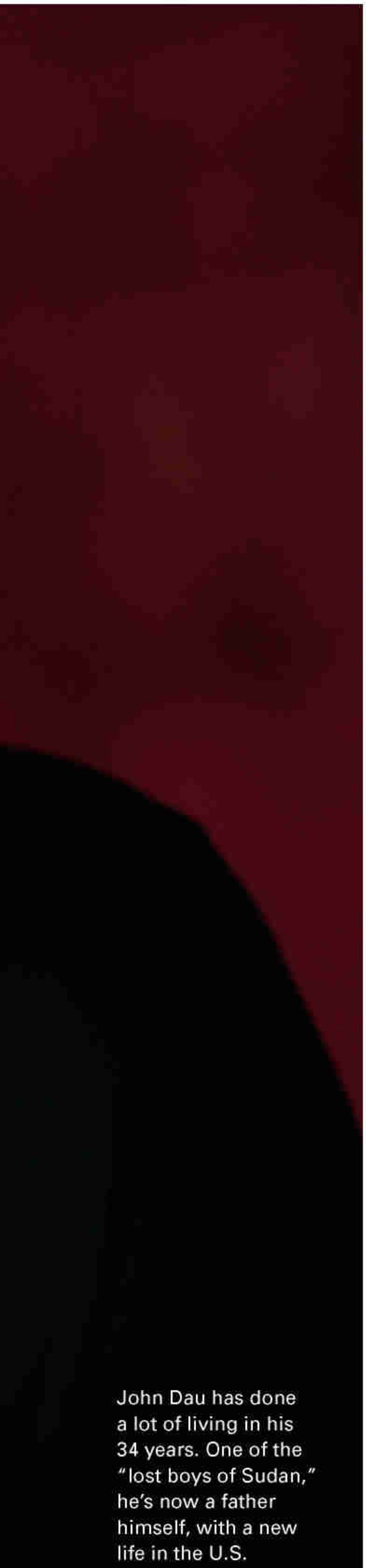
VOICES



John Dau has done a lot of living in his 34 years. One of the "lost boys of Sudan," he's now a father himself, with a new life in the U.S.

John Dau
A Survivor's Story

WITH KAREN M. KOSTYAL

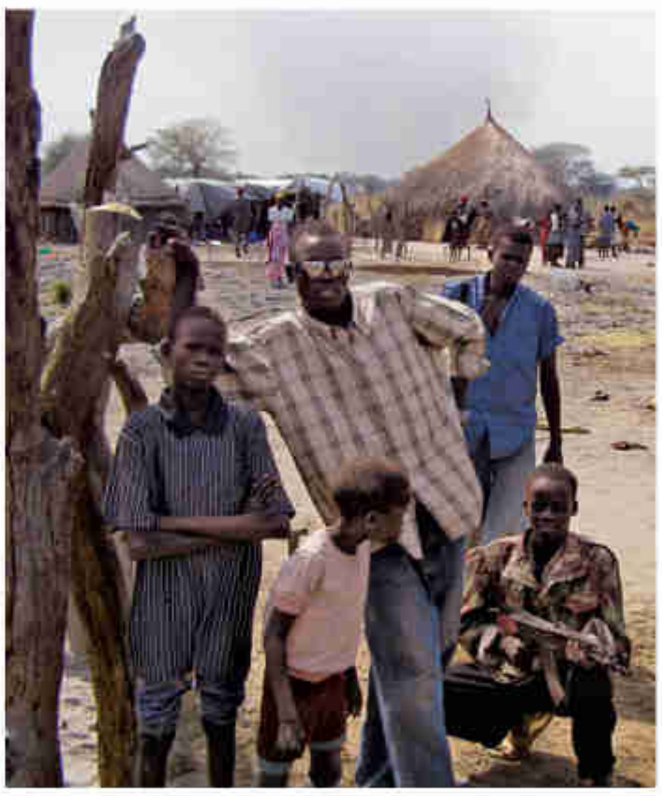
"Lost boy" seems a strange moniker for John Dau. At 34 and an elegant six foot eight, he's hardly a boy. But he's proud of the name —"lost boy of Sudan," to be exact. Dau is one of the thousands of African males in southern Sudan attacked in the 1980s and '90s by the Arab Sudanese government in the north. For 16 years, Dau was either on the run—from Arab militia and the Sudanese Army, from wild animals, from starvation and thirst—or living in refugee camps. In 2001, he was among the lucky few chosen to immigrate to the United States, a place he had never heard of until he learned to read at the age of 17.

When I think of Sudan, I like to remember life in my village. The land there was good, with plenty of water and grasslands for the cattle and goats that my people, the Dinka, survive on. But in 1983, when I was ten, the troubles began. Sudan's Arab president, Gaafar Muhammad Nimeiri, declared that Sudan would become a Muslim state and that sharia law would be the law of the land. But we did not want this. So John Garang, a Dinka, formed the SPLA, the Sudanese People's Liberation Army, to resist the government. We Africans were the true Sudanese, he said, not the Arab colonialists who had come into our land from the north. SPLA recruits trained in Ethiopia, but sometimes they came to our village.

We children could hear the adults talking in worried tones of fighting near us, villages attacked. Soon refugees began coming to our village. We welcomed them, and my father, who was the village leader, helped feed them, even slaughtering our cows for food. We began to hear the adults say that the Arabs were killing Dinka boys particularly, so that the boys would not grow up and join the army. We grew very scared. My mother started cooking small meals, because food was scarce and because she said our stomachs must get used to less food. She told us that if the village was attacked, we, her children, must hold hands tightly, so we would not get separated as we ran.

One night as I slept—it was August, the rainy season, in 1987—I began to hear a dull thumping that seemed to be slapping me in the ear. In my sleep it was just something annoying, but then I woke up and scrambled outside the crowded hut I shared with other children. Everyone was running, and the sky was lit up by mortar blasts. I saw my father run past, so I ran after him. The women and children were running and crying. I could hear bullets, *zzzzing zzzing,* whistling

PHOTO: MARK THIESSEN, NATIONAL GEOGRAPHIC PHOTOGRAPHER



Dau's village in southern Sudan is being rebuilt after its destruction in 1987. Members of his family, including his stepbrother, above in sunglasses, and several of his cousins, are now living there again.

past us. I can still hear that sound. I thought that the end of the world the Bible talks about was here.

I kept running, following my father, out of the village into the bush. And then he kneeled down in the tall grass, to watch for soldiers, and I caught up to him, and it was not my father. It was our neighbor Abraham. He told me to be very quiet, and he grabbed me and we crawled through the tall grass to the bush. I was so scared. "Where is my family?" I asked. "They are coming, they are coming," he said, and he pulled me by the arm and made me keep running, dragging me along with him. I could hear Abraham's heart pounding.

At dawn we met a woman and her two girls from our village, and we joined them, heading east toward Ethiopia, where we thought we would be safe. My knees were scraped from falling as we ran, my feet were bloody, and I was naked, because I had left the village that way. None of us had taken anything as we fled. No food, no cooking pots. We ate almost nothing—wild roots, a pumpkin from a farmer's field. At night the mosquitoes would torment us as we tried to sleep.

Then, one day, a group of militia ambushed us. The men grabbed Abraham, forced him to the ground, and began beating him with a stick, telling him to give them money. He had no money, so they took his shirt and left him in the dirt, his back bloody. I felt lucky, because they had not killed Abraham. I do not know why they let him live.

We kept going, now heading southeast to avoid the militia, but on the seventh day, we ran into another militia. Again, they beat Abraham, and this time they beat me, too, over and over on the head with a stick. While they were beating us, they abducted the woman and girls. That was the last time we saw them.

Now, there were just the two of us with our wounds. We had to keep moving, following narrow footpaths through grasses so high they were over our heads. We stole pumpkins from farmers' fields when we could, but often we just chewed grass stems to help our hunger. We would listen for the sound of frogs, then follow that sound to find water pools. We were very careful when we went near water, as that is where others would come, including Arab militia. Abraham taught me how to stay almost submerged in the pools, with my head far back, so that only my nose would be above the water level to breathe. It was good he taught me this, because once Arabs did come to swim and relax at a river we were in. They never saw us.

What horrified me most was the night. I was afraid of wild animals, leopards and hyenas, and it was very, very cold, about 40°F. I had no clothes or covering to stay warm, so I would sleep close to Abraham.

It went on like this for several weeks, until we got near a town called Pibor Post. Here we met another group of refugees, this one with two men and 17 boys, all of them naked like me. The youngest was only about five or six. We joined them, and that gave me new life. I felt like I had comrades. Of course, being in a bigger group also caused problems. Now it was mid-October and getting drier and drier. We had a hard time finding food for so many of us, and it was much harder to move without being seen. We began walking at night and sleeping in the forest during the day. We started sending out a boy and an adult

PHOTO: JOHN DAU

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Celeste River, Northern Plains

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I could hear bullets, *zzzzing zzzing,* whistling past us. I can still hear that sound. I thought that the end of the world the Bible talks about was here.

on reconnaissance before we moved on. We lost one adult that way, and a boy also disappeared. We thought maybe a leopard got him.

We were in the territory of a hostile tribe called the Murle, most of whom were cooperating with the Arabs. As the season grew hotter and drier, food became harder and harder to find. We were getting very weak, but we kept going, toward a river called Kangen. When we got there, the riverbed was dry. No water, and hot, hot sun. We were so thirsty, and we were starving. At one point, Murle hunters killed the second man from our new group, leaving Abraham as the only adult.

We moved on, looking for water. We were crying, because we were so thirsty, but no tears came. We wanted to stop, give up, but Abraham kept pushing us to move on, saying we would find water soon. When we did not, some of the boys refused to go on. At last, we found a muddy pool, threw ourselves into it, and ate the mud, just for moisture. It had been days since we had water to drink. Our tongues were swollen, our skins gray, we couldn't talk. Abraham urinated into a little container and gave it to me to drink. Now only four of us boys were left with Abraham. Along the path, we saw dead bodies, sometimes vultures eating them. I prayed, I sang Christian songs in my mind to ask for water. Then on the second day, we came to a swampy area and ran into it and drank and drank.

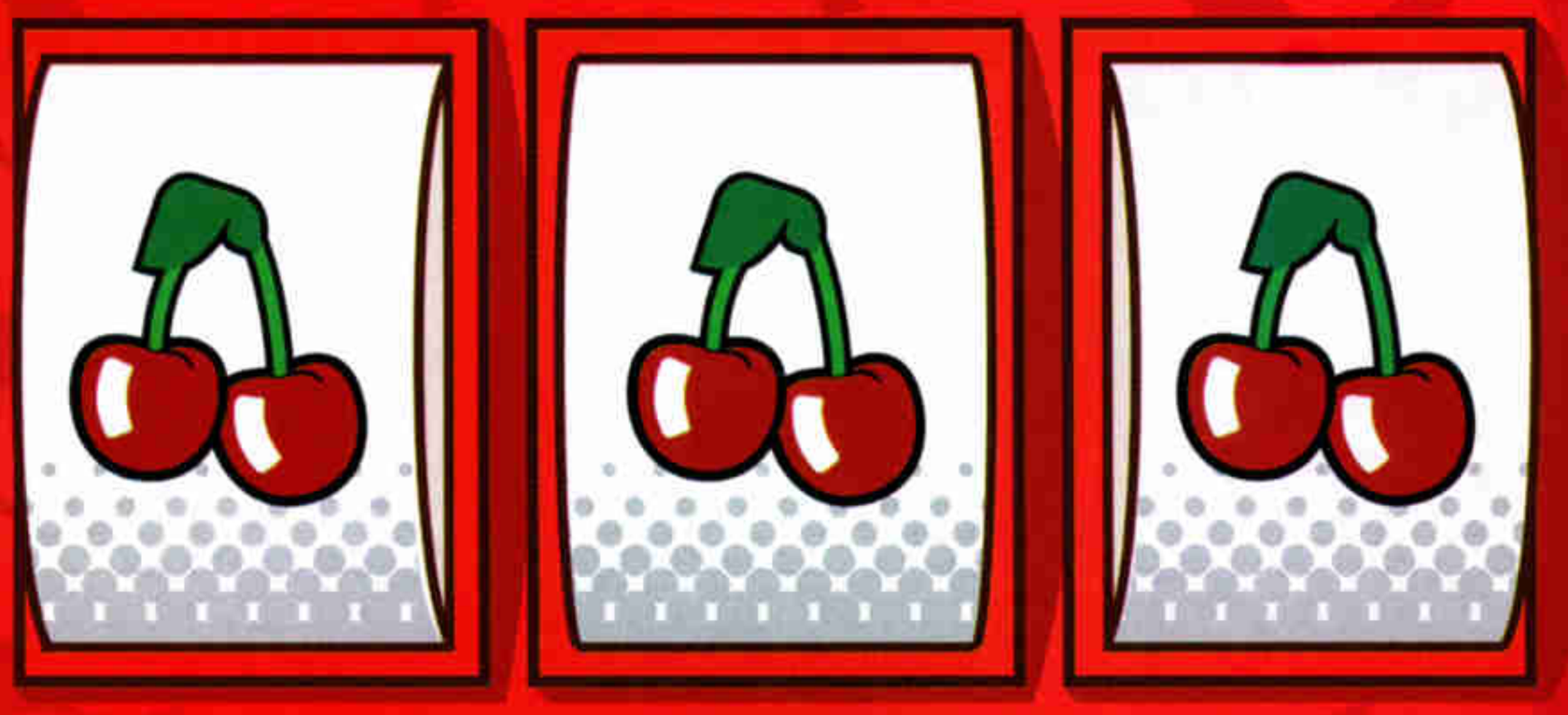
Once we had water, we focused on our hunger. We found tortoises and roasted them. That was the first time I had eaten protein since I left my village. We also collected grasshoppers and threw them into the open fire to cook. We spent three weeks there in those Kangen marshes, trying to regain our strength.

Then we continued on, finally crossing the border into western Ethiopia. This was the home of the Anyuak people, and most were pro-SPLA, so they helped us, giving us maize to take with us.

When the SPLA had come to our village, they had mentioned a camp near the Sudan-Ethiopia border called Pinyudu. That was where we had been heading all along. Finally, in late November we made it there. We had spent four months trying to reach it.

But Pinyudu was not good. Refugees were pouring in, and local Ethiopians were trying to help them; the UN did not arrive till several weeks later. I was selected leader of a group of 200 boys, and we had to take care of ourselves. We had almost nothing to eat—just a small amount of fortified cereal—and no shelter. It was so hot, as high as 116°F. The ground burned our feet as we ran from tree to tree for shade. Soon, cholera hit the camp, and life became very bad. My boys were dying all around me. I was trying to help them, but I could not. If they became sick in the morning, they could be dead by afternoon. We dug shallow graves in the dirt with sticks and our hands, just a few inches deep, to bury them. But their limbs became stiff after a few hours and poked up out of the ground. At night hyenas would come and eat the bodies. Some of the boys began to act crazy. They could not take the horrors. It was a terrible time.

After the cholera epidemic, other diseases attacked—measles, chicken pox, whooping cough. They killed a lot more boys. I don't know why I survived, maybe it was something that God planned.



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Our scientifically impeccable DiamondAura Canary Ring displays the many hues of a radiant sunrise for only a fraction of the cost.

My 5th generation Belgium gem broker is at the top of his trade and enjoys finding a special gem with a certain size, shape, color and clarity—he doesn't trade in what is available on the local market. During our visit, he proudly displayed a brilliant round-cut Canary diamond, explaining that natural yellow color diamonds are 10,000 times more rare than their brilliant white, colorless counterparts. Turning the stone in the light, he said the intensity of color is of paramount importance, and clarity increases the inherent value of a high-quality color diamond. He said this fine Canary Yellow gemstone, framed by two white diamonds, should retail for a minimum of $10,000. As my broker admired this treasure, I decided now was the time for a little amusement.

As he glanced away, I placed a similarly colored lab-created yellow Diamond*Aura* ring next to the natural mined diamond. My broker thought he was seeing double. After close examination he was astonished—the faultless, lab-created oval-cut Diamond*Aura* was so visually similar in almost every way! He started to wonder about the future of the diamond business.

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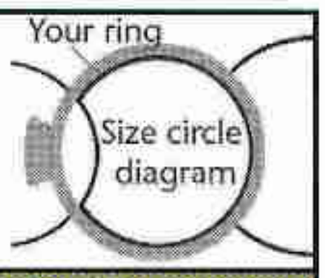

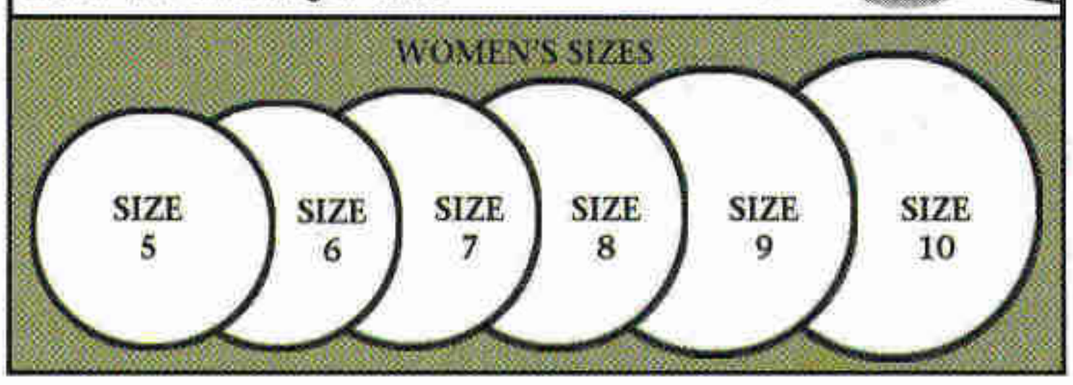

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On a return visit to his village, Dau stands under a tree where his father, a Dinka judge, once ruled on tribal disputes. Dau has established a fund to build a medical clinic near here.

Then, slowly, the camp became organized. My group grew to 1,200 boys, and we built mud-and-thatch shelters. We were given clothes, too. I had a T-shirt with some symbols on it. Years later, when I learned to read, I realized the symbols said U.S.A. We were taught how to dig latrines and began getting more food, even milk. We would leave the milk in the hot sun until it curdled, something we Dinka love. Still, some boys would leave the camp, and locals accused them of raiding fields and orchards. Some boys were abducted by Anyuak; we heard they used the boys' bodies to trap leopards for their skins.

After four years at Pinyudu, adults at the camp told us we must flee, because the camp was going to be attacked by locals. The only choice was to cross back into Sudan. We figured out a way to make backpacks out of meal sacks and pieces of plastic to put food in. Then we all left the camp together, 27,000 of us, almost all boys, walking down a narrow path single file. The line went on for days.

When we got to Gilo River, it was very full and strong, and we could see crocodiles waiting away from shore. We were gathered there on the riverbank when suddenly Ethiopian rebels attacked, firing on us. I dived into the river and began swimming as hard as I could. Another boy dived almost on top of me, but he could not swim well, and he clutched at me. I tried to help him, but I didn't have the strength, and the river was forcing us both under. I had to leave him. Somehow, I made it to the other side. We lost about 9,000 boys and a few men that day on the Gilo River. But 18,000 of us, mostly Dinka boys, had made it back to our homeland.

John Dau's ordeal was far from over. The lost boys spent nine months in the SPLA-held town of Pochala, until the Sudanese government began bombing the town. Dau left with 1,200 boys, and little adult supervision, and fled south toward Kenya. For the next six months, the boys suffered starvation, thirst, and ambushes and bombing attacks by the Sudanese government. Some 800 boys eventually made it to the massive Kakuma refugee camp in northern Kenya. Dau spent the next ten years there. In an outdoor classroom, he was taught reading, English, math, geography, history, and civics. He's now working on a bachelor's degree at Syracuse University, and he's established a fund to build the Duk Lost Boys Clinic in southern Sudan. Many of his friends and family remain in refugee camps in eastern Africa. □

■ **Movie** *God Grew Tired of Us,* a film based on the experiences of Dau and other lost boys, opens in theaters in the U.S. starting January 12.

■ **Book** John Dau's own account of his life, published by National Geographic Books under the same title, *God Grew Tired of Us,* is available in bookstores as of January.

■ **On the Web** Learn how Dau regained hope after his long ordeal of survival and find out how you can support the lost boys of Sudan at **ngm.com/0701.**

PHOTO: ALEER DENG LEEK

Remnant patches of Brazilian rain forest, the world's most biologically diverse habitat, edge land chainsawed, bulldozed, and scorched to make way for crops and cattle. Hard-to-remove trees may be left standing. At current clearing rates, and with climate change continuing, scientists predict that 40 percent of the Amazon will be destroyed and a further 20 percent degraded within two decades.

LAST OF THE AMAZON

BY SCOTT WALLACE • PHOTOGRAPHS BY ALEX WEBB

In the time it takes to read this article, an area of Brazil's rain forest larger than 200 football fields will have been destroyed.

The market forces of globalization are invading the Amazon, hastening the demise of the forest and thwarting its most committed stewards. In the past three decades, hundreds of people have died in land wars; countless others endure fear and uncertainty, their lives threatened by those who profit from the theft of timber and land. In this Wild West frontier of guns, chain saws, and bulldozers, government agents are often corrupt and ineffective—or ill-equipped and outmatched. Now, industrial-scale soybean producers are joining loggers and cattle ranchers in the land grab, speeding up destruction and further fragmenting the great Brazilian wilderness. *(Continued on page 49)*

Manoki Indians displaced from their ancestral territory—a fate shared by many of Brazil's 170 indigenous Amazonian peoples—return to reclaim the land ritually and lament its degradation.

Industrial-scale soybean farms such as this 100,000-acre operation in Nova Mutum in the state of Mato Grosso help make Brazil the world's second largest exporter of the legume. Highly mechanized, the farms employ only one person for every 400 acres.

A boy mourns activist Dorothy Stang at a gathering to mark the first anniversary of her murder. The 73-year-old nun, who dedicated her life to saving the forest and helping workers, was killed by hired gunmen in 2005 after trying to stop ranchers from clearing land. White crosses represent 772 victims of land wars in the state of Pará, and 48 red crosses symbolize local people now under death threats.

(Continued from page 43) During the past 40 years, close to 20 percent of the Amazon rain forest has been cut down—more than in all the previous 450 years since European colonization began. The percentage could well be far higher; the figure fails to account for selective logging, which causes significant damage but is less easily observable than clear-cuts. Scientists fear that an additional 20 percent of the trees will be lost over the next two decades. If that happens, the forest's ecology will begin to unravel. Intact, the Amazon produces half its own rainfall through the moisture it releases into the atmosphere. Eliminate enough of that rain through clearing, and the remaining trees dry out and die. When desiccation is worsened by global warming, severe droughts raise the specter of wildfires that could ravage the forest. Such a drought afflicted the Amazon in 2005, reducing river levels as much as 40 feet and stranding hundreds of communities. Meanwhile, because trees are being wantonly burned to create open land in the frontier states of Pará, Mato Grosso, Acre, and Rondônia, Brazil has become one of the world's largest emitters of greenhouse gases. The danger signs are undeniable.

All of it starts with a road. Except for a handful of federal and state highways—including the east-west Trans-Amazon Highway and the controversial BR-163, the "soy highway," which splits the heart of the Amazon along 1,100 miles from southern Mato Grosso north to Santarém in Pará—nearly every road in the Amazon is unauthorized. There are more than 105,000 miles of these roads, most made illegally by loggers to reach mahogany and other hardwoods for the lucrative export market.

In Brazil, the events set in motion by logging are almost always more destructive than the logging itself. Once the trees are extracted and the loggers have moved on, the roads serve as conduits for an explosive mix of squatters, speculators, ranchers, farmers, and, invariably, hired gunmen. The land sharks follow the roads deep into previously impenetrable forest, then destroy tracts to make it look as if they own them. Land thievery is committed through corruption, strong-arm tactics, and fraudulent titles and is so widespread that Brazilians have a name for it: *grilagem,* from the Portuguese word *grilo,* or cricket. *Grileiros,* the practitioners, have been known to age phony land titles in

Cowboys herd prime assets: Beef exports earn Brazil three billion dollars a year. With cattle numbers now topping 60 million, the demand for new pastureland drives much deforestation.

a drawer full of hungry crickets. When Brazil's agrarian reform agency, Instituto Nacional de Colonização e Reforma Agrária, reviewed Amazonian land ownership records over the past three years, it voided more than 62,000 claims that appeared to be fraudulent.

Guarantã do Norte, a city of 32,000 at the northern extremity of the paved section of BR-163, is the regional headquarters of Brazil's environmental protection agency, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA). With only a handful of inspectors to monitor thousands of square miles of territory, Márcio da Costa, the IBAMA chief, is overwhelmed. He works from a makeshift office behind the charred wreckage of the former headquarters, which was torched by an angry mob in 2004 after IBAMA agents and police broke a ring of timber traffickers, shutting down illegal sawmills and issuing millions of dollars in fines to loggers in the nearby town of Alta Floresta. The inquest into the arson failed to produce a single suspect.

A sputtering air conditioner barely churned the soupy air as da Costa showed me a 2004 logging certificate, along with a carbon copy. The copy, signed by an export inspector 1,500 miles away in southern Brazil, listed thousands of cubic feet of wood nowhere to be found on the original document—all contraband. "Yesterday, we seized five trucks loaded with timber coming out of the same area," da Costa said.

In 2005, after gunmen hired by grileiros murdered Sister Dorothy Stang, an American-born nun and environmental activist, the Brazilian government accelerated a crackdown, suspending logging permits throughout the Amazon—most of which had been falsified to launder illegal timber. Federal police and IBAMA intensified their investigation into irregularities in the timber business. Waves of troops were dispatched to Mato Grosso and Pará. They seized truckload after truckload of contraband timber. Of the more than 300 people arrested, about 100 turned out to be IBAMA officials involved in a far-reaching conspiracy to sell millions of cubic feet of endangered hardwoods to the U.S., Europe, and Asia.

To reduce fraud, Brazil will soon introduce electronic logging certificates. Meanwhile, to aid in policing the sprawling Amazon hinterland, government agents are turning to satellite

Sawdust flies as a logger illegally fells a hardwood on a private ranch. "The Amazon is too big for police to shut down all illegal operations," says Enrico Bernard of Conservation International.

technology and remote sensing to alert them to the work of grileiros. Yet even when officials spot a *desmatamento,* or illegal clearing, they are usually hamstrung by a lack of manpower or equipment. And when the police do react, the resources they manage to scrape together can be modest.

Such was the experience of José Rosa, a rancher in the frontier town of Matupá, 20 miles south of Guarantã do Norte, who had discovered that grileiros were cutting trees on his property. It's not that Rosa objected to the idea of clearing land—he himself plans to plant 2,500 acres in the coming year—it's just that someone else was blatantly trying to steal his. Despite federal pledges for more resources to combat timber mafias and land sharks, the only help Rosa could round up was a tiny posse of two IBAMA agents and a local cop. Among them, they carried a single pistol and a pump-action shotgun—not much of an arsenal against heavily armed grileiros. To buy gasoline for their pickup truck, the IBAMA agents had to dig into their own pockets.

Evanoir Tibaldi, 42, the commander of this ad hoc detail, has spent 15 years working for IBAMA on the front lines in northern Mato Grosso. When I asked about the satellite imaging system that is supposed to give field agents the data they need to catch grileiros red-handed, Tibaldi replied, "We don't even have Internet in our office—it's a joke."

Rosa, in his grimy red sport shirt and battered hat, didn't look the part of wealthy *fazendeiro,* or plantation owner, with an 18,000-acre spread and 3,500 steers. Getting to his land required a two-hour drive east from town, down a dirt road and across flat plains and rolling hills, where blocks of forest still stood amid brilliant green fields of rice and soybeans. "The land here is perfect for soy," Rosa said.

On his property, we headed uphill through fenced-off pasture and entered the darkness of the forest along a two-rut road made by grileiros. We crossed a stream, so clear and inviting that we stopped for a drink. As I beheld the green cathedral that towered above us, I had the sense that we were day-tripping in a sacred place that should have taken weeks of arduous trekking to reach. An iridescent blue morpho butterfly lilted past, one of a million *(Continued on page 59)*

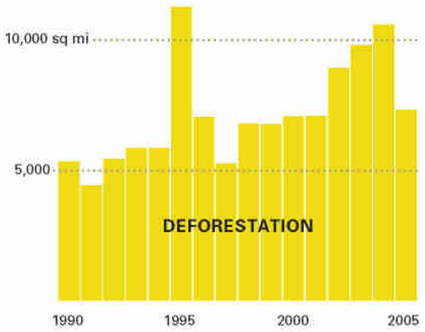
THE EMBATTLED AMAZON

Each year, thousands of square miles of Brazil's rain forest fall to agriculture and development. Though 16 million acres of protected land have recently been set aside, the Amazon Basin's decline continues.

VENEZUELA
COLOMBIA
PERU
BRAZIL
BOLIVIA
AMAZONAS
RORAIMA
ACRE
RONDÔNIA
Boa Vista
Rio Branco
Porto Velho
Negro
Amazon
Juruá
Purus
Madeira
NON-FOREST VEGETATION
Proposed hydroelectric dams
AGRARIAN LAND REFORM IMAGE
INDIGENOUS AREA IMAGE
FIRE IMAGE
2,500 sq km
250,000 hectares
2,500 sq mi
1.6 million acres
0 mi 150
0 km 150

EXPLOITING THE FOREST

Brazil holds about 30 percent of Earth's remaining tropical rain forest. The Amazon Basin produces roughly 20 percent of Earth's oxygen, creates much of its own rainfall, and harbors many unknown species. But the Amazon is under constant attack as settlement spreads and exploitation of its natural abundance continues. Between 2000 and 2005, Brazil lost more than 50,000 square miles of rain forest.



The Amazon Basin extends more than 2.6 million square miles through seven countries, with nearly 70 percent in Brazil.

KEY

DEFORESTATION

Deforested area: Clear-cutting for ranching and farming is the main destroyer of Brazil's rain forest. Undetected selective logging consumes additional forest. About a fifth of the Brazilian Amazon's 1.6 million square miles of natural cover has been stripped.

Fire: Red crosses (main map and inset at right) represent forest fires on one day, September 17, 2005. The number of fires nearly doubled early this decade. Half are accidental; the rest are set to clear land. The resulting release of carbon dioxide helps make Brazil a leading contributor of greenhouse gases.

Urban zones: Tens of thousands of square miles are classified urban in the Brazilian Amazon, where development and habitat destruction keep swallowing up wilderness. The region now contains 13.5 million people, 70 percent of whom live in or near cities.

Land reform: Since 1994, more than half a million poor, landless families have been granted property in agrarian reform settlements. Many of these settlers make quick money by illegally selling timber and land. Road networks creating fish-bone patterns through forest are the visible imprint of this activity (above).

Roads: Ecological destruction follows roads. Eighty percent of deforested land is within 30 miles of a road.

PROTECTION

Protected areas: Hundreds of state and federal parks and reserves cover 15 percent of the Brazilian Amazon. About half is strictly off-limits to any kind of development (though enforcement is lax), while sustainable production is allowed elsewhere.

Indigenous areas: About a quarter of the Brazilian Amazon is set aside as Indian land. Indigenous peoples' respect for ancestral grounds can preserve islands of pristine wilderness amid destruction (right).

Edge effects: In cleared areas, wind, human activity, and the presence of livestock degrade adjacent patches of rain forest.

MAP BY MARTIN GAMACHE
RESEARCH BY MARGUERITE B. HUNSIKER, NGM MAPS

SOURCES: AMAZON INSTITUTE OF PEOPLE AND THE ENVIRONMENT; GLOBAL FOREST WATCH; WORLD RESOURCES INSTITUTE; SOCIO-ENVIRONMENTAL INSTITUTE, BRAZIL; BRAZILIAN INSTITUTE FOR GEOGRAPHY AND STATISTICS; NATIONAL INSTITUTE FOR SETTLEMENT AND AGRARIAN REFORM, BRAZIL; NATIONAL INSTITUTE FOR SPACE RESEARCH, BRAZIL; BLUE MARBLE, NASA; MODIS LAND COVER PRODUCT, BOSTON UNIVERSITY; JEFFREY E. SCHMALTZ, MODIS RAPID RESPONSE TEAM

IMAGE SOURCE: MODIS RAPID RESPONSE TEAM, GODDARD SPACE FLIGHT CENTER, NASA

Timber mills spew smoke across BR-163, Brazil's "soy highway," in Mato Grosso. Environmentalists fear that when the road is fully paved, assaults on the forests flanking its 1,100-mile length will intensify.

Golden cargo on the Madeira River, this boatload of soybeans belongs to Blairo Maggi, the "King of Soy." The world's largest producer, growing 350,000 acres of soybeans, Maggi is also the governor of Mato Grosso. He insists that concerns about Amazon deforestation are exaggerated.

(Continued from page 51) wonders still harbored by this primal forest. But for how much longer? Recalling the murky stew I'd seen in streams already overrun by farmland farther south, I figured it would be only months—not even a year—before these deep, mysterious shadows were exposed to scorching sunlight and the cool, clean water no longer fit to drink.

Bouncing along washed-out tire tracks overhung by low branches, we suddenly emerged onto a wider, newly graded road. "These aren't poor people doing this," Rosa said. "These are land grabbers. They have a lot of money. If they find me out here alone, they will kill me."

The invaders were brazen enough to have erected and locked a gate across the road. We proceeded on foot. Tibaldi signaled for silence as he pulled his Beretta 38 from his shoulder bag. A short way on, we came to a clearing and a ramshackle structure of lashed poles topped by an orange tarp large enough to shield a dozen men. Tibaldi reached under a table and pulled out a box filled with supplies: sugar, flour, coffee, utensils. "They've run from us," he said. All was silent, except for the yelping of a pair of toucans in the treetops. The day was growing long, rain clouds were building in the east, and no one wanted to be caught here with darkness falling.

Someone had evidently tipped off the grileiros. Rosa was furious. Next time he'd try to enlist the help of the federal police—men from outside the area. "It's the only way they won't know in advance," he hissed, eyeing the local cop. "But you can't say that here. To survive in Brazil, you have to shut your mouth and play dumb."

The Amazon land rush has its roots in the 1970s, when Brazil's military dictatorship pursued a policy of "*integrar para não entregar,*" meaning "occupy it or risk losing it." Destitute settlers followed the central axes of penetration, the Trans-Amazon and BR-163, into the jungle, escaping poverty in Brazil's overcrowded south and northeast. Many perished or gave up, but others survived and adapted to the harsh life, practicing slash-and-burn farming.

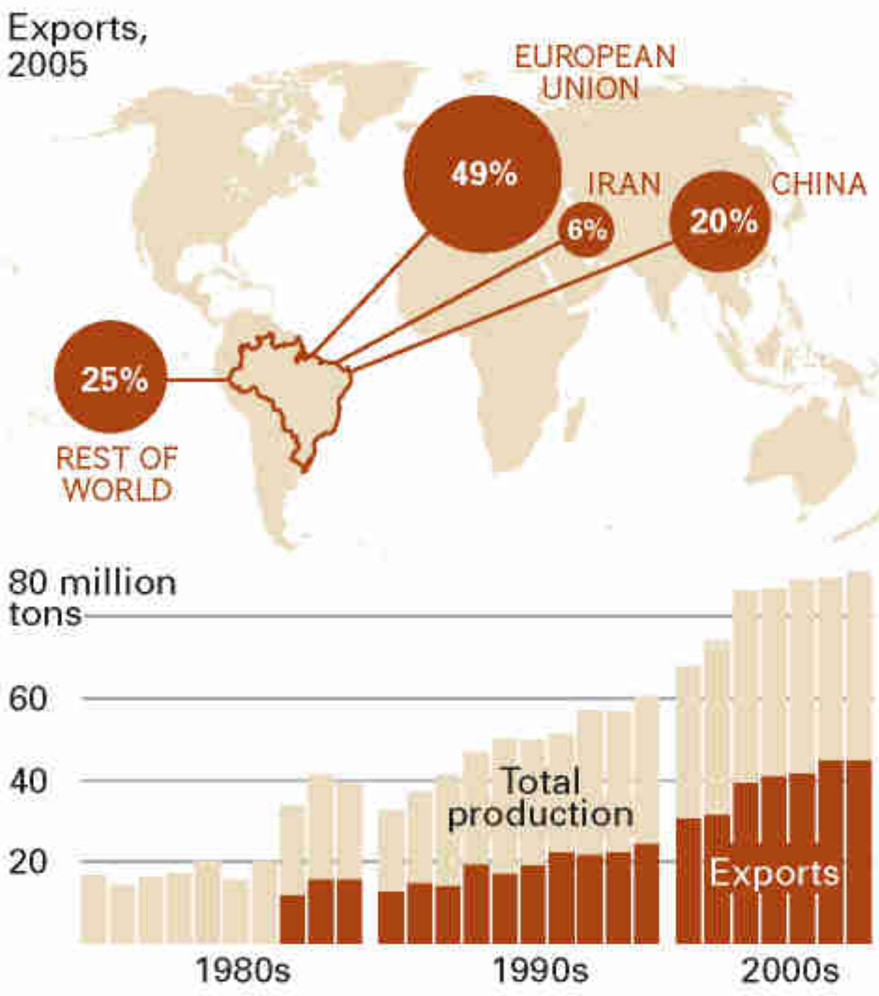
The poorest settlers were rarely given title to the land they worked, but the government awarded concessions to the well connected—blocks of up to 7,400 acres—to encourage logging, ranching, and other development. If grantees (usually

absentee landlords) failed to put the land to productive use within five years, they would forfeit the right to permanent ownership, and control was to revert to the federal government. Most grantees did nothing but still considered themselves the rightful owners. Meanwhile, landless squatters moved in from adjacent lots, working plots whose ownership the government failed to resolve. That has fueled a bloody showdown pitting the powerful absentee elites who raze forest for agribusiness against family farmers who clear small patches for crops but still depend on intact forest around them for survival.

"What's happening today in Amazonia is a clash between two models of development," said Felicio Pontes, one of a new breed of government lawyers seeking to prosecute corruption, land fraud, and environmental crimes in the Amazon. We were standing in a mock cemetery of 820 crosses that symbolized the human cost of the land wars in Pará, on the first anniversary of the murder of Dorothy Stang. "The first model was implanted during the military dictatorship, based on timber extraction and cattle. It's predatory because it causes death, it's not renewable, and it devastates the forest." The alternative model, preached by Stang, is what Pontes calls social environmentalism. The first concentrates wealth, the second calls for its dispersion in small-scale agroforestry collectives.

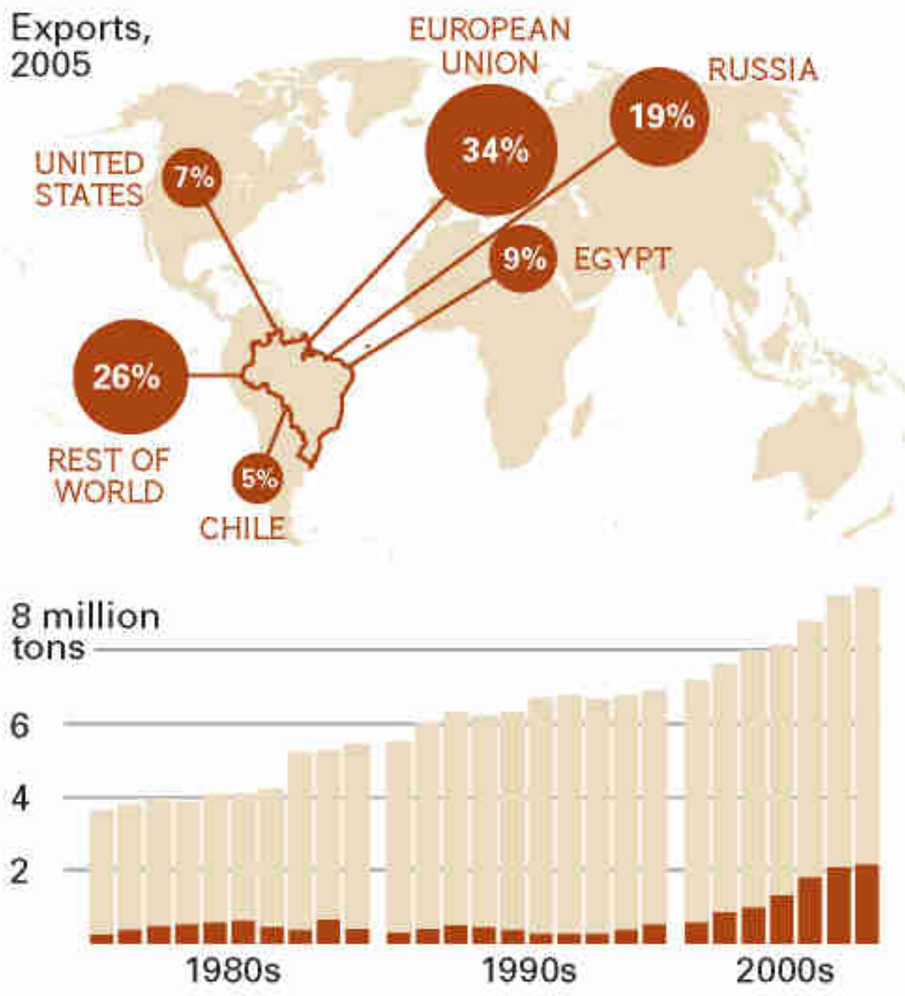
Dorothy Stang, born and raised in Ohio, a sister of Notre Dame de Namur, was revered for her dedication to the ideal of family farmers who extract their sustenance in harmony with the forest. From her base in the frontier town of Anapu, she worked unceasingly to transform settlers along the Trans-Amazon Highway into environmentally conscious, cohesive, and combative communities, able to resist violent cliques of ranchers and speculators who would lay claim to the same land. Stang saw human rights and environmental conservation in the Amazon as inextricably

WORLD DEMAND FOR BRAZIL'S PRODUCTS



SOY

Soybean production in the Brazilian Amazon soared after heat-tolerant varieties were introduced in 1997. Brazil may soon lead the world in soybeans, surpassing the U.S.



BEEF

The world's largest exporter of beef since 2004, Brazil now supplies nearly every country, including emerging markets such as Algeria, Romania, and Egypt.

intertwined. Though poor settlers themselves damage the forest, Stang believed they could learn to manage their land sustainably as a matter of self-preservation. "The death of the forest is the end of our lives," she told her followers.

Her last mission, to save a remote tract of jungle known as Lot 55, ended on the morning of February 12, 2005, when two gunmen confronted the petite 73-year-old nun on a secluded jungle path. A conversation ensued, overheard by a witness who later testified at the men's trial. Stang admonished them—the land was not theirs, they had no right to plant pasture grasses for livestock.

"So, you don't like to eat meat?" one of the assailants taunted.

"Not enough to destroy the forest for it," she replied.

"If this problem isn't resolved today, it's never going to be," the man snarled.

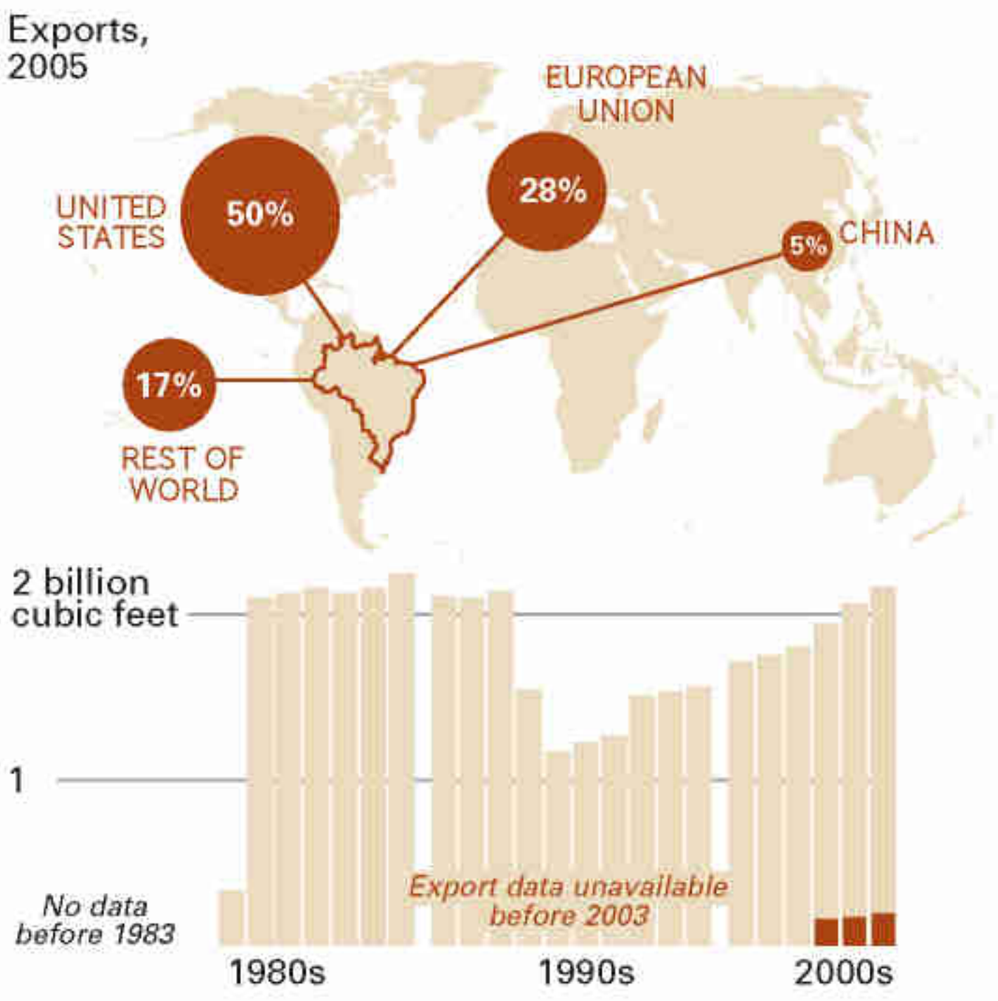
Stang saw him reach for his gun. She opened her Bible to Matthew and read from chapter five, "*Bem-aventurados os que têm fome e sede de justiça, pois serão satisfeitos*—Blessed are they who hunger and thirst for justice, for they shall be satisfied." As she turned to go, Rayfrán das Neves Sales leveled his revolver and squeezed the trigger.

IN BRAZIL, THE EVENTS SET IN MOTION BY LOGGING ARE ALMOST ALWAYS MORE DESTRUCTIVE THAN THE LOGGING ITSELF.

Blairo Maggi, governor of the state of Mato Grosso, is seen by the environmental movement as the poster boy for predation. Maggi is "O Rei da Soja," King of Soy, the world's largest single producer. Maggi acquired a less flattering honorific when Greenpeace gave him its Golden Chain Saw award in 2005, Mato Grosso having led Brazil in Amazon deforestation for the third straight year, coinciding with his first three years in the governor's palace.

Besides growing soy, corn, and cotton on three gigantic ranches and several smaller ones—almost a million acres in all—Maggi extends credit to and buys soy from some 900 midsize growers. His company, the Maggi Group, built an entire city, Sapezal, in western Mato Grosso to service a single plantation. And rather than waiting for the federal government to pave BR-163 all the way to the Amazon River at Santarém for transshipment of soy overseas, the Maggi Group created an infrastructure of silos, tugs, and barges to store and transport it down the Madeira River to its own deepwater port at Itacoatiara.

With reddish hair and a spreading paunch, the



TIMBER

Demand for Brazilian hardwoods in Europe, the U.S., and Asia has been growing in recent years. Most timber from the Amazon Basin is taken illegally and stays in Brazil.

SOURCE: ECONOMIC RESEARCH SERVICE, USDA


582
582
AQUI

Corner store hangouts are a common sight in the dirt-road neighborhoods around frontier cities such as Altamira in Pará. In the 1990s, after the government offered new agricultural subsidies, powerful elites drove squatters off rural land. Many settled on urban fringes.

Federal police in Pará drill a hole for explosives, preparing to blow up one of many illegal landing strips used by absentee ranchers and farmers to inspect their holdings.

50-year-old Maggi retains a boyish air that belies his reputation as a foe of the forest. His tough, can-do image has made him intensely popular in his home state and a rising star on the national scene; he does not discount a run for the presidency. Maggi is of Italian descent, having inherited land—and his business acumen—from his father, André, who once sold seed to farmers in the southern state of Paraná, then worked his way north, opening the agricultural frontier of Mato Grosso and founding an agribusiness empire.

Blairo Maggi's fortunes have paralleled Brazil's accelerating deforestation and emergence as a global agricultural powerhouse. The country is the world leader in beef exports and second only to the U.S. in soybeans. "The only place left for serious expansion of soy is Brazil," says Oswaldo de Carvalho, a biologist with the Amazon Environmental Research Institute (IPAM). That means more trees will fall in Pará and Mato Grosso.

To Maggi, deforestation is an overblown issue, a "phobia" that plagues people who can't grasp the enormity of the Amazon. "All of Europe could fit inside the Amazon," he says, "and we'd still have room for two Englands."

What does he think of Dorothy Stang's vision of small growers carrying out sustainable projects in harmony with the land? "*Totalmente errado*—Completely wrong," Maggi says, adding that without heavy subsidies, such projects run counter to the march of history and are doomed to failure. "All business tends toward concentration. Unit prices fall, and you need huge volumes to survive."

Not all environmentalists see Maggi in unqualified negative light. "He has seen the wisdom of doing things right on private property as he tries to position Mato Grosso as a world economic superpower," says Dan Nepstad of the Woods Hole Research Center in Massachusetts. The center, together with IPAM, its Brazilian counterpart, is conducting research at Maggi's 202,000-acre Tanguro Ranch, located in the headwaters of the Xingu River. One of their experiments involves assessing the ability of mulch made from microbe-rich rain forest leaf litter to regenerate soil depleted by years of monoculture and ranching. With prodding from Nepstad and others, Maggi supports proposals to certify soy grown by internationally accepted environmental and social standards—standards yet to be written. Maggi has already imposed

Agents from IBAMA, Brazil's understaffed environmental protection agency, join a local police officer (with shotgun, at center) for a raid on *grileiros,* land grabbers, illegally clearing forest.

conditions on his growers: no illegally cleared land, no slave labor, no spraying of agrotoxins within 500 meters of a stream. "There is potential for a win-win situation," says Nepstad, who believes that three-way partnerships among NGOs, the government, and the private sector offer the best hope for stopping rampant clearing.

"We're very responsible environmentally and socially," Maggi said, as we began a tour of Tanguro. "Everything we're doing is aboveboard and within the law." He pointed proudly to the ranch's gleaming cafeteria and the spotlessness of the grounds. "Look around," he said, "you won't find a single scrap of plastic here." Motioning to a barnlike structure that stored herbicides and pesticides, he said, "We keep all our agrotoxins properly ventilated until use."

In a steady rain, our vehicle fishtailing in the mud, we approached a denuded gully straddling a narrow stream; a closer look revealed hundreds of saplings. "When we bought this property," Maggi said, "this riverbank was totally stripped. Now we're regenerating the area."

We continued on a service road, straight as a ruler, along the edge of a mile-long field of yellow-green soy. On one side, row after row of calf-high bushes presented a perfect scene of modern mechanized agriculture. A casual observer might have marveled at the bright green luster of the plants, unaware of the toxic mix required to achieve that sheen. Soybeans need large amounts of acid-neutralizing lime, as well as fertilizers, pesticides, and herbicides. From scientists to native villagers, nearly everyone but Maggi spoke to me with alarm about toxins seeping into the watershed. Indian communities such as the Enawenê-Nawê in Mato Grosso complain of poisoned water and dying fish.

Maggi does not perceive any ill effects from soybean cultivation. "It's environmentally beneficial," he said, looking me straight in the eye. "The land here is very poor. If you don't take the right corrective measures, you couldn't produce anything. It's not true that soy degrades the soil. On the contrary, it puts into the soil what naturally isn't there. Afterward, you can grow anything you want." Researchers agree that proper management of soy fields can increase soil productivity. But in reality, no one knows for sure how long the thin, highly acidic

When the paving of BR-163 is complete, land speculators may pressure 300 surviving Panará Indians in their village of Nãnsêpotiti. Once scattered in nine settlements in southern Pará, the Panará were decimated by diseases in the 1970s, when the road was built.

Amazon soils can be propped up, raising the possibility of an eventual two-headed catastrophe: environmental and economic.

On the other side of the service road, a line of magnificent 100-foot-high trees draped in lianas—the very core of an ancient primeval forest—was starkly revealed in cross section. Such vistas of geometric fields carved from virgin jungle have become commonplace in Pará and Mato Grosso as the soy frontier advances. While many of the incursions are illegal, many are not. Farmers are entitled to clear up to 20 percent of their land, as long as they maintain the other 80 percent as a so-called legal reserve. If the vegetation on their land is "transitional"—somewhere between rain forest and savanna—they're allowed to clear 50 percent. But laws are only as good as the will to enforce them. "Satellite imagery shows that in many frontier zones there is nearly zero compliance," says Stephan Schwartzman of Environmental Defense, a U.S.-based NGO. "People have to believe breaking the law has consequences."

It appears that landowners are starting to believe it. In the crackdown since Stang's murder, farmers who have cleared more forest than their legal limit have been looking for ways to legitimize their holdings. Sympathetic to their situation, Governor Maggi is allowing them to buy up tracts of non-contiguous forest to comply with the legal reserve statute. He promises stiff fines for violators, but he enforces the law reluctantly. "Brazilian producers are the only ones in the world who are obliged to maintain a reserve," Maggi said. "There should be a royalty for leaving those areas intact—they need to be compensated in some way."

Brazilians are not the only people profiting from soybeans. Along the 500-mile paved stretch of BR-163 between Cuiabá and Guarantã do Norte, there are no fewer than five John Deere dealerships. And at harvest time, fleets of the trademark green-and-yellow combines rumble across the fields flanking the highway, pouring rivers of golden soy into open-bed trucks bound for shiny new silos belonging to ADM, Bunge, and Cargill—all American multinationals.

Because BR-163 is not yet paved to the Amazon River, most of Mato Grosso's soy still leaves the state in diesel-belching convoys that must ply 1,200 treacherous miles to Brazil's congested southern ports. In 2003, when the government announced plans to lay asphalt on the last 650 miles of BR-163 from Guarantã do Norte to Santarém, a frenzied land grab ensued. The scale of devastation forced officials to suspend the paving until they could formulate a forest-management strategy for the region. That plan was unveiled in February 2006, one year after the death of Sister Dorothy Stang, when President Luiz Inácio Lula da Silva announced the protection of 16 million acres of rain forest on the western flank of BR-163 between Guarantã and Santarém. (This is nowhere near Lot 55, the patch of forest Stang died defending, where grileiros are still felling trees.) Within the protected area, companies deemed environmentally responsible will be given limited logging concessions, but no clear-cuts or settlements will be allowed.

The new district adds to an expanded mosaic of parks, reserves, and conservation units that, together with indigenous territories, forms the bulwark of defense against the expansion of the frontier in the central Amazon. These measures may be paying off. Deforestation rates fell more than 30 percent in 2005, and preliminary numbers for 2006 are also down. Indian lands in the Xingu watershed are proving an especially effective barrier. There, militant Kayapó and Panará warriors armed with clubs and shotguns patrol their borders using satellite images furnished by international NGOs to pinpoint illegal clearing. As Stephan Schwartzman puts it: "Where Indian land begins is where deforestation ends."

But Brazil's measures to protect the Amazon must be weighed against its other ambitions. These include plans to build seven dams on the environmentally sensitive Xingu and Madeira Rivers, as well as roads, power lines, oil and gas

pipelines, and large-scale mining and industrial projects. The dams will power aluminum smelters, and shipping channels will facilitate river transport of exports to Chinese markets. The dams will also flood millions of acres of forest, releasing methane and other greenhouse gases, destroying biodiversity, and forcing indigenous communities to flee ancestral lands.

As indigenous people intuitively grasp, the benefits the Amazon provides are of incalculable worth: Water cycling (the forest produces not only half its own rainfall but much of the rain south of the Amazon and east of the Andes), carbon sequestering (by holding and absorbing carbon dioxide, the forest mitigates global warming and cleanses the atmosphere), and maintenance of an unmatched panoply of life. But the marketplace has yet to assign value to the forest: It's far more profitable to cut it down for grazing and farming than to leave it standing. "Tropical deforestation is a classic example of market failure," Schwartzman says. Oddly enough, Maggi would probably agree with Schwartzman's solution: "It's urgent to find mechanisms to compensate forest peoples, and their governments, for the ecosystem services their forests provide."

For Cargill, a Minnesota-based food conglomerate, the greatest urgency lies in getting soybeans to market as cheaply as possible. Anticipating the eventual completion of BR-163, Cargill opened a warehouse and deepwater port in Santarém in 2003. Until it can transport soy there by road, Cargill, like Maggi, has been moving much of it by barge via the Madeira River. "We've exported close to two million tons," Douglas Odoni, the plant's operation manager, told me with pride. We stood on a catwalk above the Cypriot-flagged freighter *Evdoxos* as a giant nozzle disgorged soybeans into the vessel's belly at the rate of 1,350 tons an hour. Within two weeks, the *Evdoxos* would dock in Amsterdam and unload 52,000 tons of Brazilian soybeans at a crush plant that makes oil and animal feed. "They buy only from us," Odoni yelled above the din of the machinery.

"THESE ARE LAND GRABBERS. THEY HAVE A LOT OF MONEY. IF THEY FIND ME OUT HERE ALONE, THEY WILL KILL ME."

—JOSÉ ROSA, RANCHER

Cargill's operations in the Amazon have been controversial from the start. Federal prosecutors are suing the company over its alleged failure to provide an adequate environmental impact study of the port. Cargill's installation of a soybean washer and dryer has infuriated forest defenders, whose protests have repeatedly closed down the plant. To avoid spoilage, soybeans must be cleaned before they're transported, and for farmers around Santarém, it was only after the arrival of the washer and dryer that they had a buyer for soy and an incentive to grow it. Deforestation in the area has soared. "Maybe it's true that if Cargill weren't here, they wouldn't plant soy," Odoni conceded. But "if they couldn't sell soybeans to us, there would be no taxes and revenues for the local community."

Last summer, Cargill and Brazil's other big soy traders agreed to a two-year moratorium on buying soy grown on newly deforested land in the Amazon. The agreement is sending a signal to soy producers that the environmental impact of their operations is increasingly important in the world marketplace.

For many in the community of Belterra, an hour's drive south of Santarém, the moratorium comes too late. As the head of the Rural Workers Union local, Auricelia Núnes, 33, represents some 5,000 farming families. These people, she said, had been coaxing a decent

living from their small plots, when, in the late 1990s, outsiders from southern Brazil began buying up property for a pittance. "There are many small farmers who don't know the value of money," Núnes said. "They thought the money would last, but it doesn't." Now they languish in Santarém's growing slums.

Those who refused to sell found themselves encircled by an encroaching wasteland, as whining chain saws and raging fires consumed the trees right up to the edge of their land. Their yards were overrun with vipers, bees, and rodents escaping the apocalypse, and when tractors began spraying the cleared fields, toxic clouds of pesticides drifted into their homes. "Their health was in jeopardy," Núnes said. "Many started getting sick. Their animals started dying."

Núnes and her husband, Everaldo Pimentel, still live as traditional family farmers, growing corn, squash, and beans and raising livestock on their 70-acre plot. But Pimentel wanted to show me another place, 15 minutes away by car. We followed yet another dirt road past miles of soy before turning onto a narrower track that traced the edge of a freshly plowed field—the driveway to the farmhouse his grandfather had built in the shade of a large mango tree. This, Pimentel said, was where he had grown up. Four years ago, his father sold the farm to a stranger. Workmen immediately cut down every tree. "In 30 seconds," he said, "they can cause more devastation than a small farmer who's been on the land for 30 years."

Pimentel couldn't have cared less that we were trespassing—there were no hired guns to be seen. He pointed to a cracked slab of concrete in the ground, overgrown with weeds and vines. "The house was here." A dozen giant mango trees lay on the ground, toppled by chain saws and left to decay under the blistering sun. "We never would have sold it if we knew what this guy was going to do," Pimentel said. He hoisted himself onto the stump of an old mango. "My grandfather planted this one a hundred years ago," he said, looking out across a desolate, empty field. Pimentel buried his face in his hands and began to weep. "It was beautiful here," he said. "You should have seen it." □

Disappearing Forests Join our online discussion and share your thoughts on the global impact of the diminishing Amazon rain forest at **ngm.com/0701**.

Ten-year-old Jeremias Silva lives with his parents and two brothers in an isolated government settlement in Mato Grosso. His father, a farmer, sells illegal timber to make ends meet. "I hope for better days," Jeremias says. "Here in the forest it's not so good."

What are they doing down there?

humpback whales by the thousands gather each year in the azure depths

off Hawaii. At times they float, like this male and female, mysteriously still and silent.

Life begins for many humpbacks—like this 15-foot calf, just weeks old—in the clear waters of the

1,370-square-mile Hawaiian Islands Humpback Whale National Marine Sanctuary.

by Douglas H. Chadwick
photographs by Flip Nicklin

Remember when the biggest animals in the world seemed in danger of vanishing? It was during the 1960s and '70s, when commercial hunting had made many of the great whale species so scarce it looked as if the world would be robbed of an entire dimension of wonder.

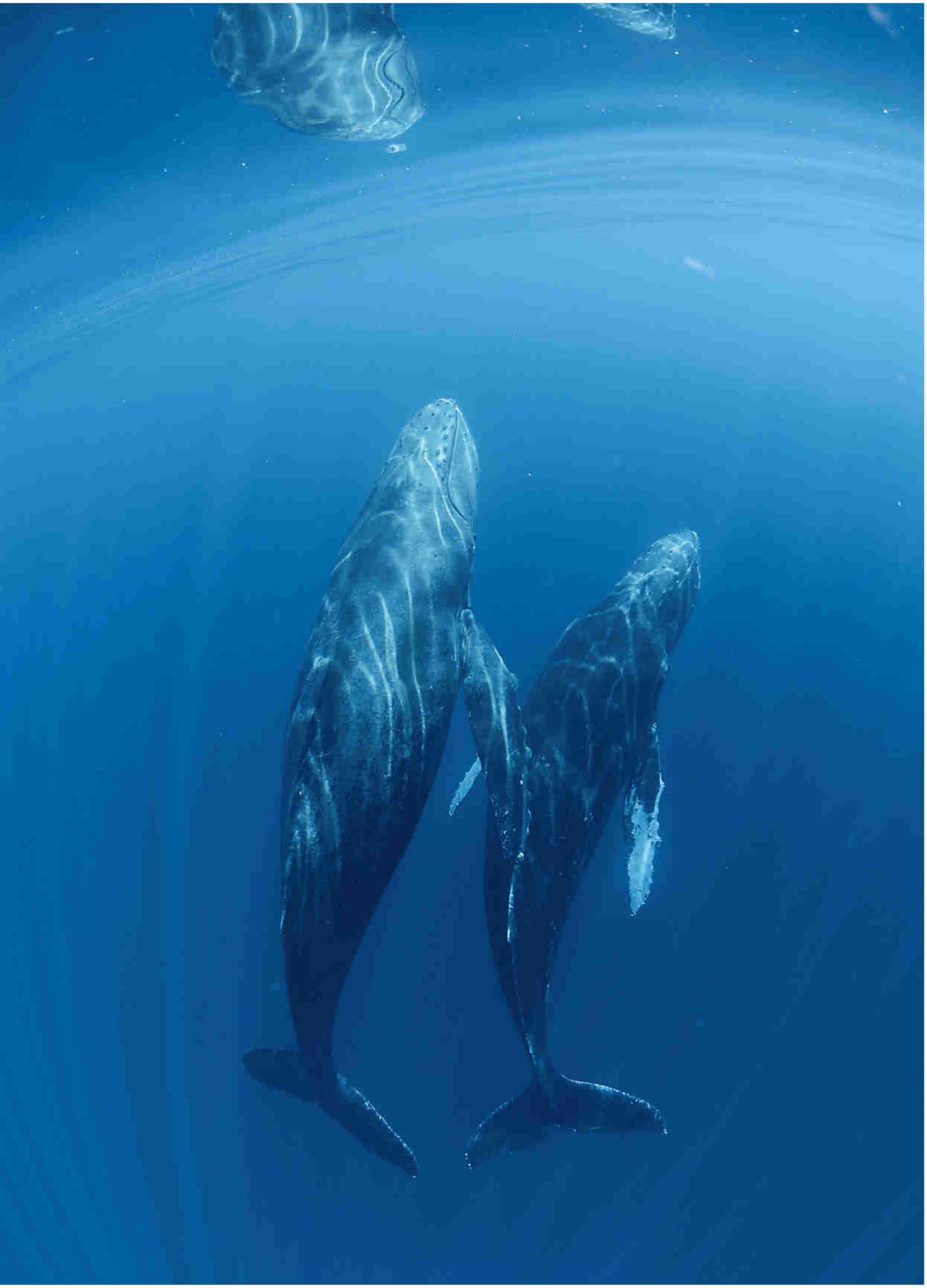
It wasn't. If you visit the 'Au'au Channel between the Hawaiian islands of Maui and Lāna'i in winter today, you'll find the ocean grown chunky with titans. Humpback whales that weigh as much as 45 tons rise and spout everywhere, roll in spirals, slap the surface with fins or tail flukes. They leap with their tails almost clearing the surface while chins reach 40 feet into the sky, then fall back in a *KER-WHOMP!* that carries for miles.

Reduced to a few thousand worldwide, humpbacks began to rebound after an international ban on killing them went into effect in the 1960s. A soon-to-be completed three-year census dubbed SPLASH, the largest, most intensive humpback whale survey ever undertaken, could put the North Pacific population alone at more than 10,000 and possibly as many as 25,000.

Half to two-thirds of those whales gather around Hawaii from late November into May, especially here in the channel and other parts of the 1,370-square-mile Hawaiian Islands Humpback Whale National Marine Sanctuary.

hanging out in hawaii

Head down, a female (above) floats motionless, one of a breathholding pair. Another pair rises in a parallel pas de deux (opposite). In winter a majority of North Pacific humpbacks gather in Hawaiian waters to give birth and mate.



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For every humpback drawing cheers from whale-watching boats as it raises a splash in the sunshine, many more lie below.

Whales ordinarily come into view only briefly, when they part the ocean's shimmer to breathe. Humpbacks, though more active at the surface than most, still spend about 90 percent of their lives below. What are they *doing* down there? They roam too widely through rough and remote seas for scientists to follow; it's no wonder the ways of whales, Earth's grandest lifeforms, are still steeped in mystery. But out in the wonderfully clear, blue, warm waters of the ʻAuʻau Channel, investigators have been gathering new clues about a crucial part of the whales' lives: courtship and birth.

Observers from the Whale Trust, a Maui-based foundation for research and education, have found that some of the submerged males are calling out the humpback's famous song, filling the seas with strange and lovely incantations. Some of the females are tending new calves as they pile on dozens of pounds daily and, in a year, double their length on their mothers' rich milk. What no one fully grasped until recently was how many other submerged humpbacks are not cruising, not singing or nursing, but simply hanging out.

"The more we searched, the more humpbacks we found just drifting along with the current at a mile or two an hour, 30 to 80 feet deep," says photographer Flip Nicklin, a longtime marine mammal observer. "Now when I look out across the channel, I picture this river of whales flowing by, hidden from ordinary view."

They don't seem to be eating either, even though many have migrated 2,500 miles or more from feeding grounds off Alaska and British Columbia and have a long return journey ahead. Some speculate that the whales roam farther offshore to at least snack now and then, but people who watch humpbacks every day see nary a poop. The animals are apparently living off the layers of blubber beneath their skin. You can do that if you're as huge as a humpback: The ability to gulp prodigious quantities of food and store fat by the ton frees the animals to travel long distances and concentrate on other vital behavior for weeks or months at a time.

The whales hanging out below don't even bother much with breathing. Instead of coming up every 10 to 15 minutes for a series of breaths as busier humpbacks do, they stay down for half an hour or so, scarcely moving a muscle. "We call them breathholders," Nicklin says. They may be conserving energy for more important activities on the winter range, namely romance.

"Crucifix block," observes Dan Salden, head of the Hawaii Whale Research Foundation, another Maui-based group, which studies humpback social behavior. He's standing on the prow of his boat, *Deep Blue*, describing a male that has risen vertically almost halfway out of the water and spread its long, winglike pectoral fins to either side, forming the shape of a cross. The move cuts off one of the 10 or 11 other males racing behind from getting any closer to the prize: a female, swimming just ahead of the pack.

Lifting his tape recorder again, Salden announces, "Peduncle throw." A different male swimmer has just whipped the whole muscular, tapering rear of its body—the peduncle, which powers the fluke—high in the air. It causes the animal's front end to swing straight downward, forcing a male that had been hot on its tail to dive to avoid a collision.

Off *Deep Blue*'s port side, several big boys near the head of the group have been veering back and forth, pushing, shoving, ramming, and swiping at each other with fins as they steam across the ʻAuʻau Channel. Now a trio is swimming parallel while keeping enormous heads lifted high, planing over the waves like fast-moving ships. "Three males motorboating," Salden says, while seawater cascades from the whales' partly opened maws and the volumes of air rushing in and out of their blowholes whistle-roar like factory pipes.

When the trio finally dips beneath the surface, the whales release streams of air from their mouths. One adds a continuous jet from the blowhole. "Bubble trail," declares Salden. "Probably

where are they going?

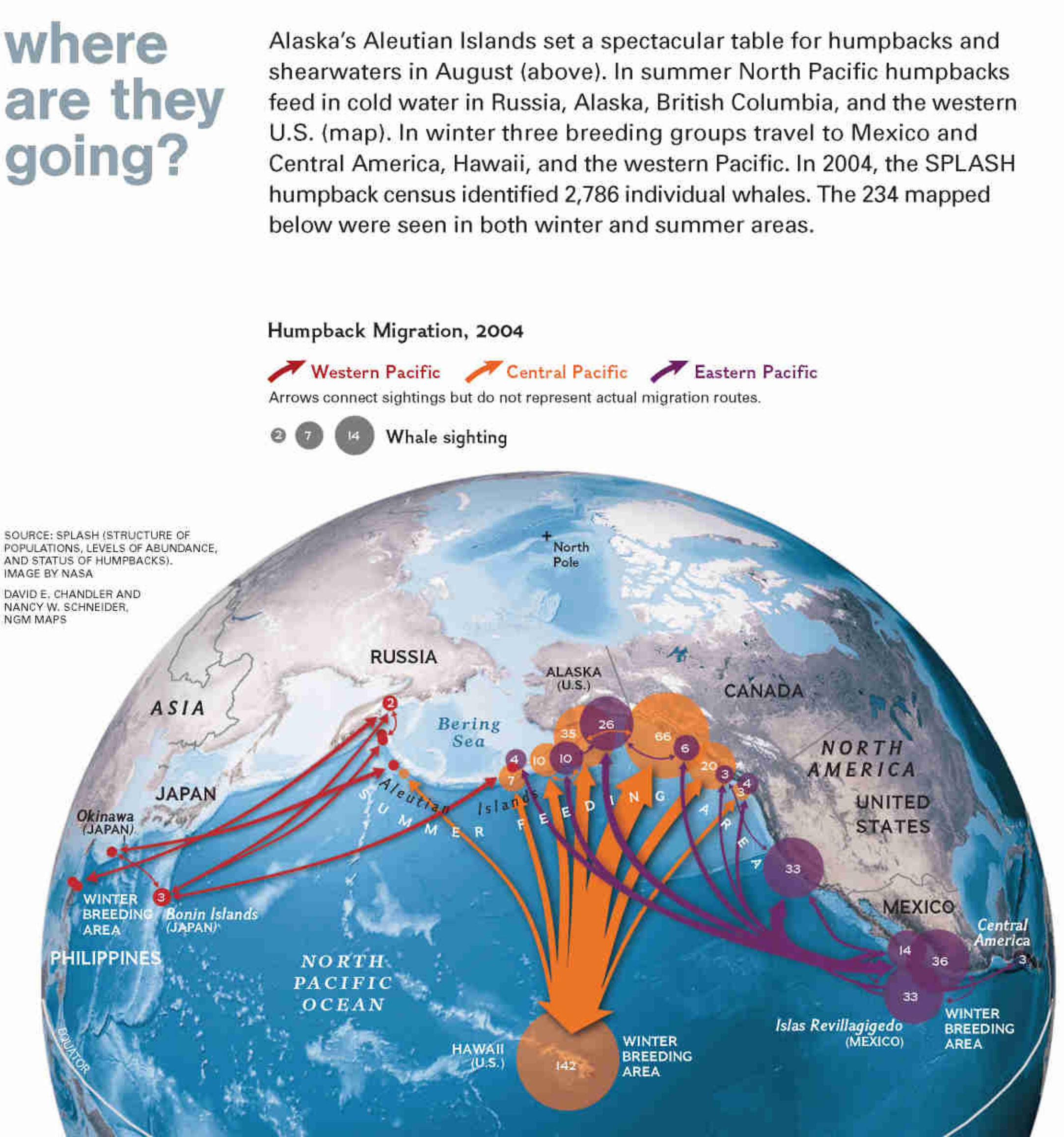
Alaska's Aleutian Islands set a spectacular table for humpbacks and shearwaters in August (above). In summer North Pacific humpbacks feed in cold water in Russia, Alaska, British Columbia, and the western U.S. (map). In winter three breeding groups travel to Mexico and Central America, Hawaii, and the western Pacific. In 2004, the SPLASH humpback census identified 2,786 individual whales. The 234 mapped below were seen in both winter and summer areas.

Humpback Migration, 2004

Western Pacific · Central Pacific · Eastern Pacific

Arrows connect sightings but do not represent actual migration routes.

2 · 7 · 14 Whale sighting



SOURCE: SPLASH (STRUCTURE OF POPULATIONS, LEVELS OF ABUNDANCE, AND STATUS OF HUMPBACKS). IMAGE BY NASA

DAVID E. CHANDLER AND NANCY W. SCHNEIDER, NGM MAPS

the dominant animal using it as a display." All at once, a male's back rises higher and higher above the water without any visible effort. That's because another male has dived underneath and started lifting him up. What term will Salden, former chairperson of the speech communication department at Southern Illinois University, Edwardsville, use for this?

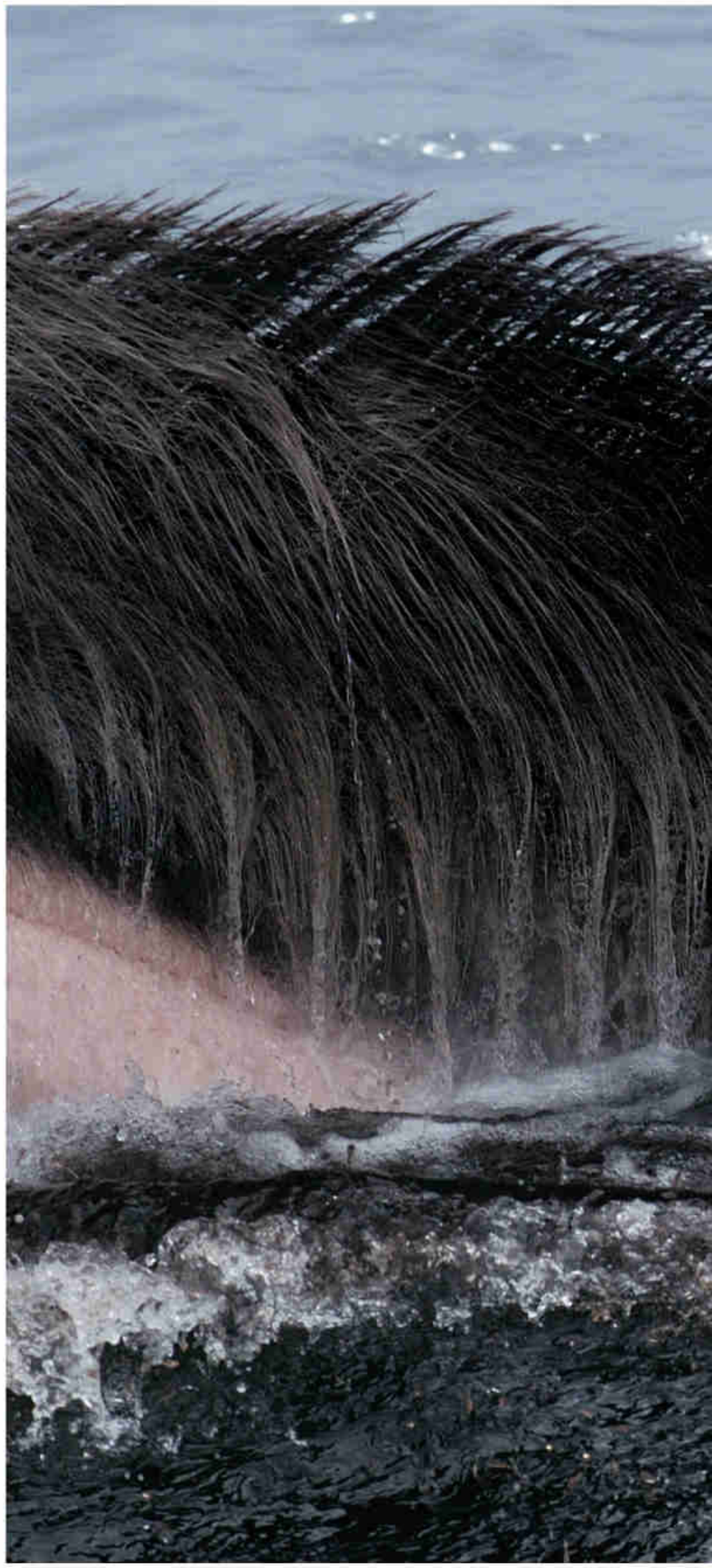
"Beaching."

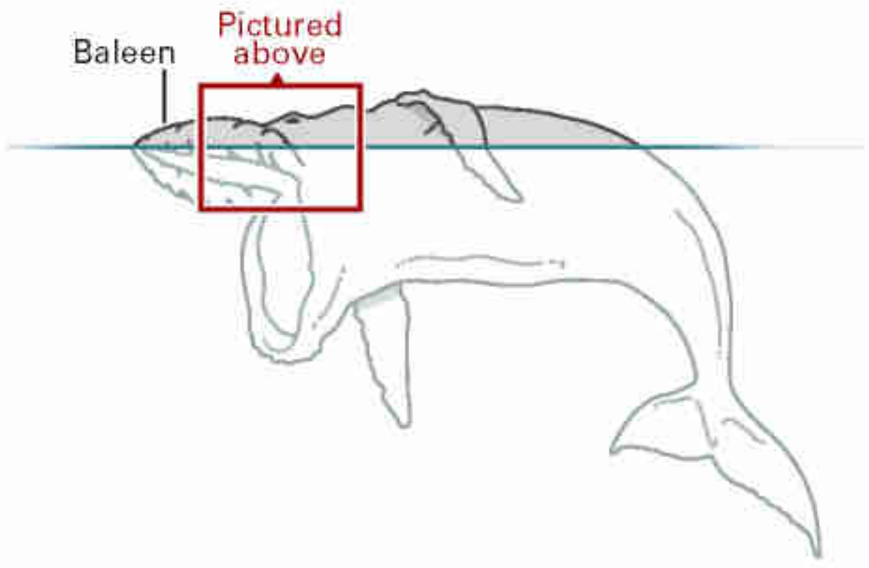
Ah. The victim does look as if he had run aground on a hidden shoal.

After taking tail photographs to identify the individuals involved—each humpback has a unique pattern of pigment and scars on the underside—Salden turns to an assistant, Peggy Stap, who has been sitting patiently on the stern clad in a wet suit and oversize fins. "OK," he says. "GO!" And she's overboard, kicking toward a roller derby in the Kingdom of Giants, one hand thrusting a video camera at several hundred thousand pounds of churning behemoths, the other hand held high out of the water to signal the whales' number and direction and also to let us track her more easily from the deck.

A few years ago, Stap operated a greenhouse and ornamental flower business in Michigan. On the last day of a vacation in Maui, she was sightseeing over coral in a glass-bottomed boat when "a mother and calf swam right underneath, looking at us with those eyes," she recalls. Stap went home, sold her business, flew back to Maui, and volunteered to take identification photos from a commercial whale-watching boat. More captivated than ever, she eventually signed on with Salden's crew.

Researchers began referring to fast-moving melees of humpbacks as competitive groups after Salden, Stap, and others found that they almost always consist of a female pursued by a squadron of males. One suitor, known as the primary escort, tends to keep closest. Typically one of the largest males, he stays busy fending off other heavyweights, the secondary escorts. They in turn contend with males trying to get past them. The action can go on for hours at a pace that causes normally white undersides of flukes and fins *(Continued on page 85)*



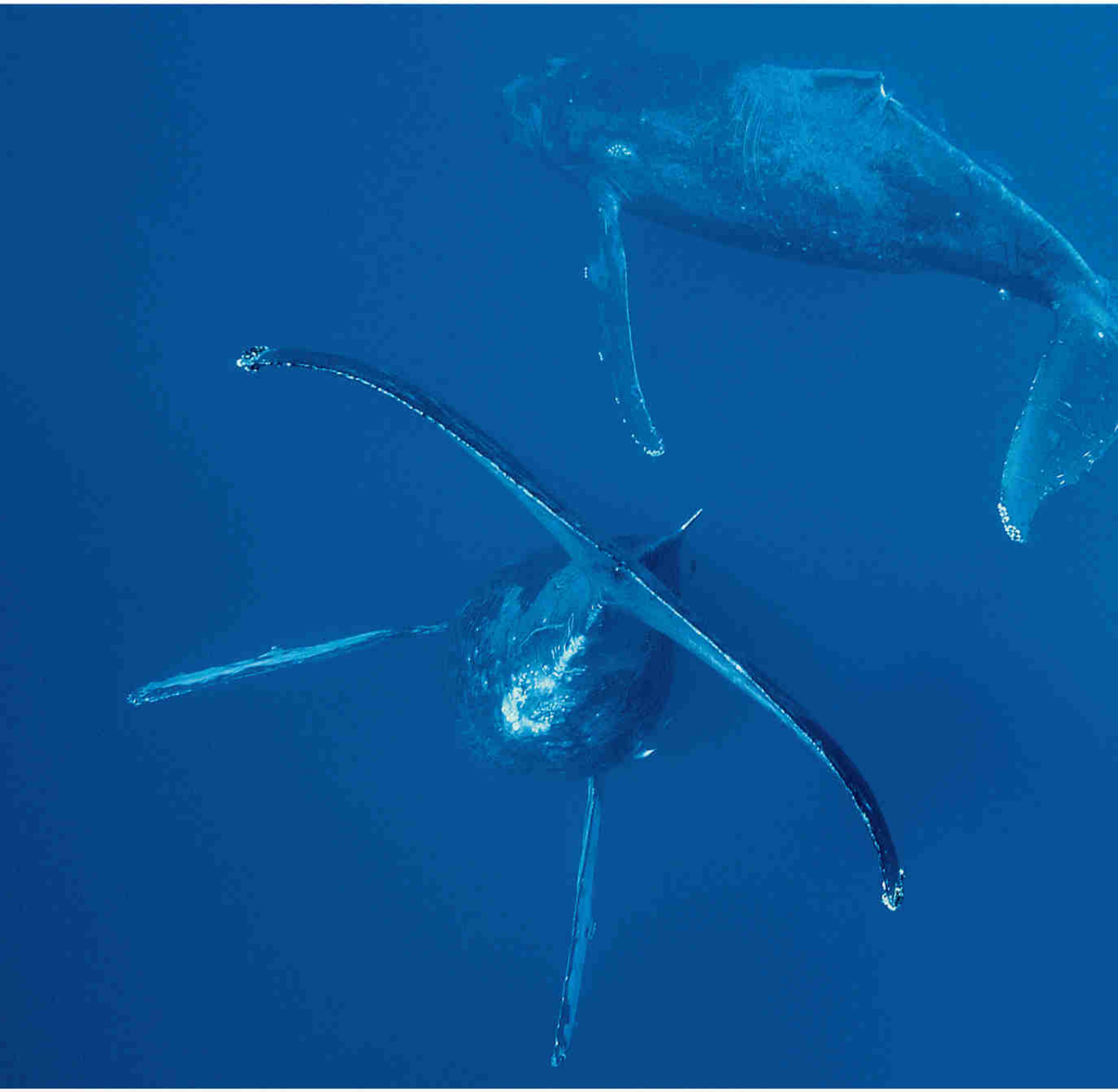


sea rakers

Not much escapes a gaping mouth feeding on krill in Alaska's Aleutians. Up to 800 baleen plates in the whale's upper jaw fray into bristly strands, which strain the water. Humpbacks also target small fish or krill with a repertoire of tactics: blowing bubbles to make "nets," pounding or herding prey with flukes and flippers, and feeding in formation.

Humpbacks share krill with a blizzard of shearwaters in Alaska's Aleutian Islands. Filling up at their

summer grounds, the whales eat little, if anything, in their winter breeding waters.



front-runner

Winner of wooing rights for the moment, one male has bested about 15 rivals in a boisterous skirmish to court the female below him. Scientists have observed these winners, called primary escorts, gain and lose their status, but none have ever seen humpbacks actually mating.

to flush pink, likely with blood from exertion.

When you have anywhere from four or five to two dozen whales crisscrossing, circling, and diving past each other, it's extremely difficult to keep track of who's doing what. New contestants keep arriving, drawn to the hubbub from surrounding areas, while others peel off or simply lag farther and farther behind as they tire.

Fresh nicks, scrapes, and gouges testify to the serious level of competition. Yet there may be cooperation too, as when two or three males gang up in what looks like an effort to block a female's progress or to push one of the main escorts off course. "I've also seen two males pancake a third," Salden says. "One came up under him while the other lunged onto his back." Are these intentional alliances, or cases of individuals selfishly joining in when others take the initiative, or merely accidents of timing? No one is sure.

Humpbacks are known to collaborate—for example, in rounding up food in their summer feeding grounds. Some work together to drive fish into shining corrals made from the whales' own rising bubbles; they then come up together through the silvery school with mouths agape. At other times they seem to cooperate in herding fish or krill against a shore or even thickets of kelp. One observer saw five humpbacks shoving an ice floe along like a tugboat fleet, perhaps in play. Others have reported small groups hurrying over to drive off killer whales harassing a lone humpback, as if they had made a collective decision to help.

Again, no one is certain about what is actually going on in the animals' large, convoluted brains. But trying to understand mammals in an environment so different from ours is part of the attraction of this ocean frontier. Whales have a way of turning questions about nature into questions about the nature of knowledge and how our human brains interpret the world.

Meagan Jones of Whale Trust knows one thing for sure about humpbacks: Even though they come into the world 12 to 15 feet long, with flippers and flukes, they are no exception to the rule that baby mammals love to climb on their

risky encounters

Worldwide some 300,000 whales, dolphins, and porpoises die each year from entanglement in fishing gear. This victim (above) off Maui was bound too tightly to be rescued, but several others have been successfully freed by rescuers since December 2005. Humpbacks are also vulnerable to ship strikes. In Hawaii six were hit in the past season, even though by law all vessels must stay at least a hundred yards away.

moms. A calf will squirm over and under its mother's flippers, or pectoral fins—her modified forelimbs. When she lingers at the surface, it will use her massive back as a playground, lurching up one side and sliding down the other, again and again. An infant that wriggles onto her rostrum, the broad bench formed by the elongated upper jaw, seems happy to perch there like some colossal amphibian equally at home in water or in air, while the mother half shoves, half carries her bulky baby. Some humpbacks have also been seen giving rostrum rides to bottlenose dolphins, occasionally lifting one so high that it resembles a passenger on the flying bridge of a yacht.

Jones focuses on whether the presence of a calf affects female behavior. She has confirmed that females rarely interact with one another in Hawaii. However, the majority of them have at least one male suitor following or, from time to time, angling ahead or closely behind as if to alter her course. More often than not, the course is relatively slow—a different level of intensity than in competitive groups. When a female rests underwater, her visitor stations himself nearby, breaking off to patrol around her now and then, on the lookout for potential rivals.

Females usually give birth every two to three years, because pregnancy lasts 11 months and is followed by up to a year of nursing and care for the developing infant. Although most females with calves don't necessarily participate in mating, Maui researchers find that some do, and males therefore court mothers with young as well as solitary females. But for all an escort's devoted attention, Jones rarely sees any cow showing the slightest interest in return. These slow-moving, undemonstrative females can be tougher research subjects than the splashy groups in which a female is pursued by a crowd of males. Jones spends hours trying to stay near a quiet female (and her calf and escort, if present) and document every move she can see. It's not uncommon for her subjects to slip away into the boundless blue before she can determine a pattern. More often, she will have almost pieced together a pattern when it is interrupted by the arrival of a new male or small band of them, which generally causes the female to flee. Either way, Jones has to start over.

Jones's typical day begins shortly after dawn. Several sunstruck hours later, everyone aboard is operating with a partly heat-melted brain. The trade winds have strengthened, and her little boat is sloshing around between white-capped waves. Time to turn for home, but Jones will be saying, "We were so close before those incoming males wrecked the last session. Let's try just one more two-hour follow." And on it goes until the team pulls into the harbor late again, fully roasted, basted in salt spray, and making plans to do it all again the next day, always in the hope of one shining moment of insight.

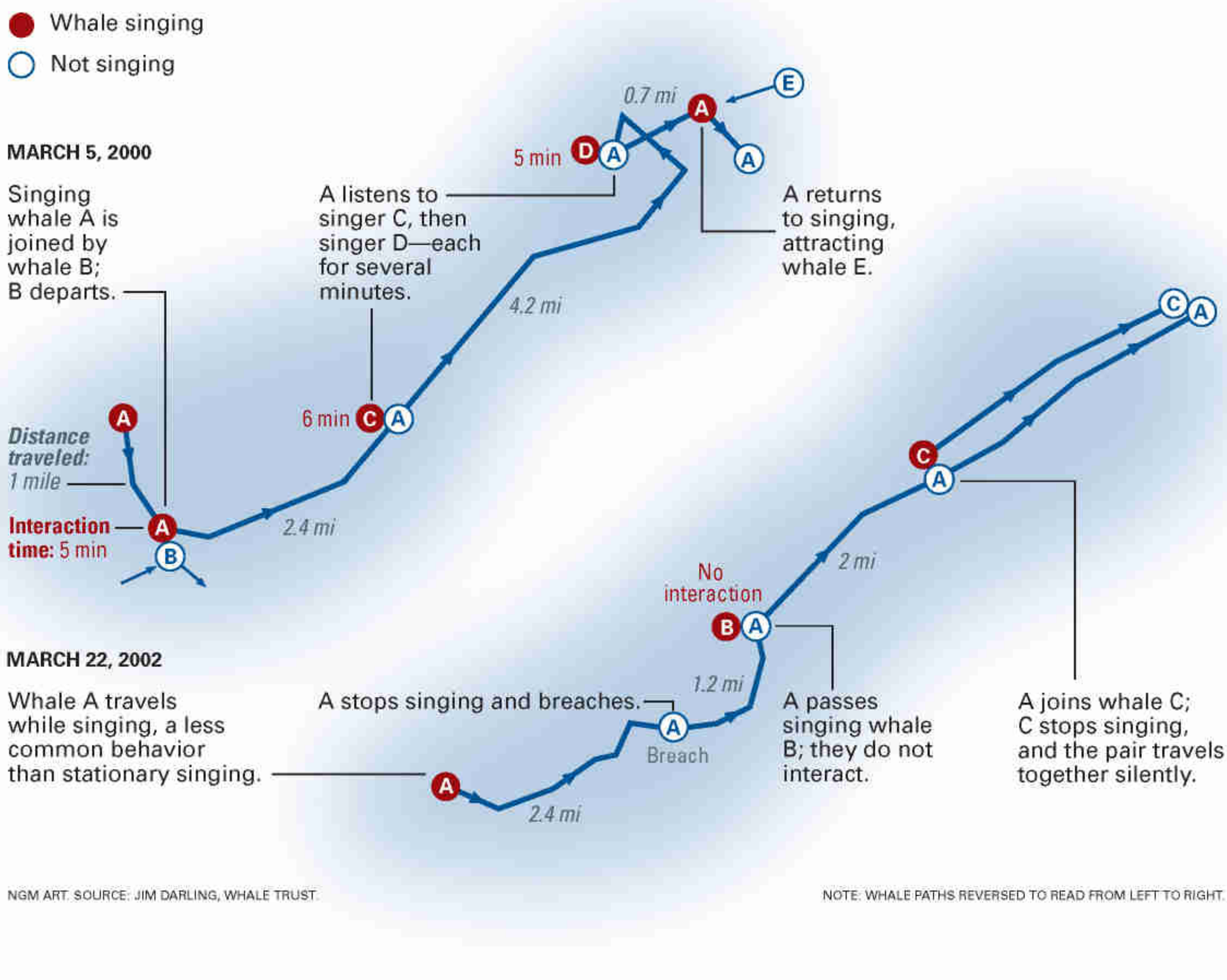
One afternoon, 50 feet deep in dazzling azure, a baby humpback rests tucked beneath its mother's flipper, then moves to nestle in its next favorite place: under her throat. A second adult hovers close by. Its darker skin, scratched and scarred, suggests that it is a male.

Jones cuts the boat engine and maneuvers her vessel into position above the whales and slightly to one side. Jason Sturgis of Whale Trust drops quietly off the transom with snorkel gear. A quarter mile away, a second boat lowers a loudspeaker into the water and begins to play a sample of the very unmusical noises—grunts, glubs, rumbles, sneers, and whines—made by males in competitive groups. Sturgis records the female's response with a video camera.

Since females without calves are the ones most likely to breed, they ought to react differently from females with calves, Jones theorizes. To prove it, she will need this combination of calm water, smoothly functioning equipment, and approachable whales for many more such experiments. During the few I witness, neither type of female seems inspired to approach the sounds. So what are the steps that lead to these standoffish females being chased by a horde of suitors? And where in any of these social sequences does actual mating take place? For now, the humpbacks' mating game remains an enigma—one almost as profound as their song. *(Continued on page 93)*

what's in a song?

A headstanding male sings a solo (opposite). Jim Darling, a marine biologist (above), records humpback songs. Below are diagrams of whale behavior during two episodes at winter breeding grounds in Hawaii. Only the males sing, and Darling, describing their behavior, says, "A singer is often joined by another, nonsinging male. The singer usually stops singing, then one, the other, or both may swim off. The song clearly has a role in male relationships on the breeding ground—and to date, there is no evidence that females are attracted to it."



NGM ART. SOURCE: JIM DARLING, WHALE TRUST.

NOTE: WHALE PATHS REVERSED TO READ FROM LEFT TO RIGHT.

Technology enhances research as Jason Sturgis of Whale Trust, a Maui-based research group, uses

a high-definition camera to film a female with her yearling floating below her.

Jim Darling has struggled for 25 years to crack the code of the humpback song. The vocalization, uttered only by males, is perhaps the longest and most elaborate known among animals. Its formal structure is built from a succession of themes, or melodies, that have a striking range of tones from piccolo chirrups to low-pitched foghorn blasts. Some scientists say they can detect rhymes. Considering how much time and energy go into producing this submarine aria, most people assumed the purpose must be to lure mates. That theory took a blow in 1997, when Darling, a Whale Trust researcher, and Flip Nicklin discovered that singers in the ʻAuʻau Channel were drawing not the opposite sex but other males.

Darling and the rest of the Whale Trust team have been using an underwater speaker to play recordings of the song. The first experiments appear to confirm that females aren't attracted to the singing, whereas males seem eager to investigate the source. Maybe the song isn't for wooing but for broadcasting a challenge, as when a bull elk bugles across the mountainsides. If so, you would expect a contest to erupt when another male comes to check out the claim.

Yet when a new male joins a singer, Darling notes, the two whales often circle each other without obvious aggression. They may even swim off together like bachelor buddies, often to join other whales. Perhaps singers are recruiting male allies to help find a female and displace the primary escort at her side. If the female tries to bolt, a fast-swimming, flipper-banging competitive group may then take shape.

Or maybe the songs are far more than simple calls to allies or rivals. Hit tunes and national anthems could be better analogies, for all we know. All the humpbacks within one region, the North Pacific, for instance, sing the same song. Only an expert like Darling can detect minor variations among subpopulations, such as the humpbacks wintering off Hawaii and those off the Philippines. Yet researchers have found that the humpback populations in other parts of the world sing distinctly different songs. The songs also change over time—from one year to the next, and even over a single breeding season.

A decade ago, the humpbacks in the channel ended their song with a rising series of whoops just before coming up for breath. The next year, the finale switched to a series of ribbits. Two years ago the song had only four themes, down from as many as eight in earlier years, and even a novice could pick out a new growly tone dominating a particular section. As of 2006, there were six themes, one with a recently added flourish of four loud squeaks, and the final noises before surfacing were more like a buzz.

Lately, researchers listening in on humpbacks along northern feeding grounds have picked up singing during late autumn and again in spring and even early summer. Navy hydrophones deployed on the sea bottom detect humpbacks singing during their long migrations as well. Could it be that the whales sing to establish their identity as a group or possibly as individuals? That they are telling others about who they are and where they come from? Or sharing lore about the currents and fish and maybe the stars?

Years of study lie ahead. "Why do I do it?" Darling wonders aloud. "Human beings like puzzles. I want to know. Period."

And perhaps the urge to know goes both ways. Nicklin recalls snorkeling some distance from a humpback when it approached within a few yards. Curiosity about humans is not uncommon among humpbacks, especially young ones. But this adult animal gently carried Nicklin toward its eye with a fin. Who's to say this wasn't a case of a fellow big-brained mammal reaching out in wonder and curiosity, as in the electric moments when a chimpanzee or gorilla first touched a researcher's hand? □

parting ways

This yearling will leave its mother within weeks. She has already shown it the way to the northern feeding grounds. On the next journey, the young whale will be on its own.

Humpback Ballet Witness the underwater grace of these sea giants at **ngm.com/0701.**

sudden

A feverish dream of the future springs from the sands in Dubai.

A foreign worker stacks fish traps near the Burj al Arab—world's tallest hotel and icon of the new Dubai. In a generation, the city's rulers have transformed this once sleepy fishing port into a hub of the Middle East.

city

Basking in the good life, expatriates watch a polo match at Arabian Ranches, a suburban-style development designed for moneyed foreigners drawn to Dubai by its well-paying jobs, social freedoms, and—until recent jumps in property values—its relatively low cost of living.

A guest at a mass wedding peruses the thick program, which lists 47 couples. Dubai's government bankrolls such events to encourage marriage of native-born couples. Most of the city's work is performed by foreigners, who now outnumber natives eight to one.

BY AFSHIN MOLAVI

PHOTOGRAPHS BY MAGGIE STEBER

There once was a sheikh who dreamed big. His realm, on the shores of the Persian Gulf, was a sleepy, sun-scorched village occupied by pearl divers, fishermen, and traders who docked their ramshackle dhows and fishing boats along a narrow creek that snaked through town. But where others saw only a brackish creek, this sheikh, Rashid bin Saeed al Maktoum, saw a highway to the world.

One day in 1959, he borrowed many millions of dollars from his oil-rich neighbor, Kuwait, to dredge the creek until it was wide and deep enough for ships. He built wharves and warehouses and planned for roads and schools and homes. Some thought he was mad, others just mistaken, but Sheikh Rashid believed in the power of new beginnings. Sometimes at dawn, with his young son, Mohammed, by his side, he'd walk the empty waterfront and paint his dream in the air with words and gestures. And it was, in the end, as he said. He built it, and they came.

His son, Sheikh Mohammed bin Rashid al Maktoum, now rules Dubai, and around that creek has built towering dreams of his own, transforming the sunrise vision of his father into a floodlit, air-conditioned, skyscrapered fantasy world of a million people. With its Manhattan-style skyline, world-class port, and colossal, duty-free shopping malls, little Dubai now attracts more tourists than the whole of India, more shipping vessels than Singapore, and more foreign capital than many European countries. The people of 150 nations have moved here to live and work. Dubai has even built man-made islands—some in the shape of palm trees—to accommodate the wealthiest of them. Its economic growth rate, 16 percent, is nearly double that of China. Construction cranes punctuate the skyline like exclamation points.

Dubai is also a rare success story in the Middle East, a region with a history of failure and stagnation. Whether Dubai represents a glitzy anomaly or a model to be copied by other Arab nations is a question worth asking these days, as the Islamic world struggles to cope with modernization. Abdulrahman al Rashid, a Saudi journalist and director of the Al Arabiya news channel, put it this way: "Dubai is putting pressure on the rest of the Arab and Muslim world. People

Eight lanes of traffic course between a mile of skyscrapers on Dubai's Sheikh Zayed Road (opposite), a stretch that was near-empty desert as recently as the early 1990s (below).

DUBAI MUNICIPALITY (LEFT)

are beginning to ask their governments: If Dubai can do it, why can't we?"

Dubai, it must be said, is like no other place on Earth. This is the world capital of living large; the air practically crackles with a volatile mix of excess and opportunity. It's the kind of place where tennis stars Andre Agassi and Roger Federer play an exhibition match on the rooftop helipad of the opulent Burj al Arab megahotel; where diamond-encrusted cell phones do a brisk business at $10,000 apiece; where millions of people a year fly in just to go shopping.

Over the past decade, I've traveled to Dubai often and grown to appreciate the quirky multiculturalism of a city where one can eat in an Italian restaurant run by an Egyptian, with an Indian head chef and Filipino waiters who break into operettas every half hour. Or watch, in the wee hours, a mob of English expatriates weaving home from a pub as the Muslim call to morning prayer echoes through the streets.

Many Americans first heard of Dubai, one of seven emirates that make up the United Arab Emirates (U.A.E.), when a state-owned company, Dubai Ports World, purchased a British firm that managed six U.S. ports. Some members of Congress reacted with alarm, charging, correctly, that

The Palm Jumeirah, a man-made island whose fronds offer beachfront lots for 4,000 villas and apartments, juts audaciously into the Persian Gulf. Dubbed the Eighth Wonder of the World, the development has doubled Dubai's 45-mile shoreline, but has also disrupted its coastal ecosystem.

the 9/11 conspirators used Dubai as a key financial transit point. Others supported the deal, noting that the U.A.E. had proved a staunch ally in the war on terror, and that U.A.E. ports host more U.S. Navy ships than any port outside the United States. In the end Dubai decided to pass on managing the U.S. ports. "We're too busy for politics," Sultan bin Sulayem, the head of Dubai Ports World, told me. "The Americans didn't want us on that deal. Fine. We move on. There's lots of business to be done."

Indeed. Dubai has created one of the most dynamic business environments in the world. "It's not just the buildings and the islands and the hotels," says Ali al Shihabi, the Princeton-educated director of a leading investment bank. "It's the soft stuff: the laws, the regulations, the liberal social environment." With no corporate or income taxes, a top-notch banking system, and a legal code that favors property and ownership, Dubai embodies old Sheikh Rashid's motto: "What's good for the merchants is good for Dubai."

And then there's his son, Sheikh Mohammed, the 57-year-old ruler of Dubai, whom Edmund O'Sullivan, editor of the *Middle East Economic Digest,* calls a "radical modernizer" and the "most significant figure in

Arabia since King Abdulaziz"—the founder of modern Saudi Arabia who leveraged his country's oil reserves to become a major world player.

Unlike a traditional Middle Eastern autocrat, Sheikh Mohammed (known to many as Sheikh Mo) manages Dubai like a good CEO. Besides keeping a full schedule of public appearances, he's often seen driving himself around the backlots of Dubai, surveying his construction sites, as his father did, at the crack of dawn. He'll sometimes show up unannounced in the workplace to ask tough questions, fire poor managers on the spot, and reward the hardest workers. From these he handpicks Dubai's next generation of executives, including many women. "Hire the best women you can find," he told Anita Mehra Homayoun, the head of marketing for Dubai's airport, when he tapped her for the job in 1996. Mehra Homayoun herself rose through the ranks of the airport's duty-free shopping operation and caught Sheikh Mo's attention by organizing car raffles and celebrity golf and tennis tournaments, and by attracting top retailers to the airport's duty-free empire. "Sheikh Mohammed makes you believe you can do anything," she said. "His vision is contagious."

Dubai: Dream and Reality

Business-friendly decrees and rapid investment in infrastructure have expanded Dubai's economy far beyond oil, which now accounts for only 6 percent of GDP. Real estate developments spill into an ever widening swath of the gulf.

The Palm Jebel Ali
Under construction

The Palm Jebel Ali
This second palm will include a ring of homes on stilts arranged to spell out a poem by Sheikh Mohammed, the city's ruler and unofficial CEO: "Take wisdom from the wise. . . . It takes a man of vision to write on water."

The Palm Jumeirah
In just 72 hours, buyers snapped up every home on this first of three planned artificial islands.

The Palm Jumeirah

Free zones
Government-designated areas draw investors by allowing businesses to operate without paying taxes or customs, with no restrictions on transfers of funds.

0 mi 2
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APRIL 2006 IKONOS MOSAIC BY SPACE IMAGING MIDDLE EAST
NGM MAPS

Another of the chosen, Mohammad Alabbar, grew up, like many Dubaians, in a tent made of palm fronds. His father supported a wife and 12 children with his fishing net. Then, in 1966, Dubai struck oil, and Alabbar went to college in the United States on a government scholarship paid for by oil revenues. (Though a windfall early on, Dubai's modest oil reserves now account for only 6 percent of GDP.) After graduation, he impressed Sheikh Mo during a six-year stint in Singapore, where he turned stagnant retail enterprises into thriving businesses. That led to a posting as Dubai's director of economic development, a role that showcased his ability to boost commerce by cutting red tape. As a reward, the government granted him land at little or no cost, and he started building.

Today he travels the world in a private jet and oversees Emaar, one of the richest real estate development companies in the world. "We have come a long way," Alabbar told me at the project site of the Burj Dubai, a towering, torpedo-like structure that will be the tallest building on the planet when it's finished in 2008. "But we must always remember where we came from. Our kids must know that we worked very, very hard to get to where we are now, and there's a lot more work to do."

Dubai is the world capital of living large; the air practically crackles with excess and opportunity.

Any day's a beach day for women whose husbands work as executives with a construction firm (above). But for laborers at the bottom of the pay scale, such as these South Asian men taking a water taxi to work (opposite), life in Dubai can be drudgery.

Who actually does that work is a touchy subject. Dubai is not, demographically, an Arab city-state: Fewer than one in eight residents are citizens of the U.A.E., and South Asian guest workers make up more than 60 percent of the population. Many educated Indians live a comfortable life in Dubai, and a few have become rich. ("Dubai is the best city in India," quip the fortunate.) For others, however, Dubai is a dead end.

The local press had been reporting labor unrest the evening I visited one of the squalid neighborhoods where tens of thousands of guest workers live. The laborers' barracks stood among many battered, squat buildings along a dirt and gravel road littered with garbage. Hundreds of men with sun-soaked brown faces scuttled past in tank tops, baggy slacks, and torn flip-flops. Some of these workers joined in recent strikes, fed up with being treated as "less than human," in the words of Human Rights Watch. The average laborer makes about five dollars a day, working 12-hour shifts in scorching heat. (Human Rights Watch reported nearly 900 construction deaths in 2004, including deaths from heatstroke.)

Listen to their stories, and you learn that many workers are trapped here, mired in debt to unscrupulous agents back home who charged them exorbitant fees for their work visas. "If I didn't have to pay back my fee, I'd go home today," one man told me. "We have nothing," said Kutty, a short, sunken-cheeked 25-year-old from the Indian state of Kerala. "We are living a nightmare here, and nobody cares."

Reacting to such abuses—and the bad publicity they generate—the government recently announced it would allow workers to unionize, and ordered all contractors to halt work for four hours a day during the heat of July and August.

Dubai's troubles don't end there. Creating man-made islands offshore, for example, may have been a brilliant, if outrageous, business decision—waterfront properties sell for 7 million to 30 million dollars—but in the process, environmentalists say, Dubai has killed coral, destroyed turtle nesting sites, and upset the marine ecology of the western Persian Gulf. And behind the glittering skyscrapers lies a late-night world of fleabag hotels and prostitutes, Indian and Russian mobsters, money launderers, and smugglers of everything from guns and diamonds to human beings.

The night I stopped by the Cyclone Club, the prostitutes on hand hailed from Moldova, Russia, China, eastern Europe, the Caucasus, and various countries in East Africa. Their clients were Arabs, Europeans, Asians, and Americans. Music throbbed, drinks flowed, and soon the couples headed for the exits. I met a Chinese woman who goes by the name Muri. "I only go Cyclone two times a week," she said in halting English. During the day she works as a chef at a Chinese restaurant. Her clients, she said, tend to be Europeans or Americans on leave from the war in Iraq. "The Arabs like the European girls and Russians." I asked if she knew of trafficking rings that deal in Chinese girls. "Yes, of course," she said, wrinkling her eyebrows. "Very bad. Some girls very young."

A few days later I asked a top aide to Sheikh Mohammed whether Muri was right about the influx of Chinese prostitutes and traffickers. "It's not easy to stop the ones who come to Dubai by choice," he told me, "but we have no tolerance for traffickers." The U.S. State Department, however, reports that Dubai's efforts to curtail the trade fall short of even "minimum standards," and estimates that some 10,000 women in the U.A.E. may be victims of sex traffickers. *(Continued on page 112)*

More than half Dubai's population lives in workers' camps like this one, where South Asian men sleep in crowded dormitories that open onto standing sewage. Most owe money for the cost of their trip to Dubai. Many wait months for wages; some never see them.

Jumeirah Beach Residence rose in just 36 months, its concrete poured by laborers working day and night. Some critics are questioning the speed of change and a lack of planning: The towering apartment complexes stand like a wall, cutting off the rest of Dubai from its coast.

Does Dubai represent a glitzy anomaly or a model to be copied by other Arab nations?

Tourists eagerly pay for an "authentic" night in the desert (above), while club-goers at a nightspot catering to expats break Muslim traditions by their revealing dress (opposite). Dubai's meteoric success has left the city with a vexing problem: how to retain its identity.

Dubai's relaxed approach to these and other problems does prompt criticism, though carefully muted. "We need to slow down, things are going too far," one prominent writer told me, referring to unrestrained development running roughshod over local culture. He asked that I not use his name. Said another native, "I know that some of my Arab friends only visit us because we have foreign prostitutes here. This is shameful."

Dubai's tolerance can also be a good thing. Alongside its bars and nightclubs, there are mosques and churches and Hindu temples, and, for a city with so many competing religions and nationalities, it is remarkably free of ethnic conflict. "I don't know who's a Sunni and who's a Shia, and I don't care," Sheikh Mohammed told me during a brief meeting. "If you work hard, if you don't bother your neighbor, then there is a place for you in Dubai." Even Israelis can do business (quietly) with Dubai.

While the Dubai model—built on freewheeling capitalism, entrepreneurship, and religious moderation—might be a blueprint for other developing nations, Dubai is uniquely positioned for the 21st century largely due to the vision and ambition of one man. Other Arab leaders might emulate Sheikh Mo or his methods, but in the end—and some would say thank goodness—there's only one Dubai.

Before I left the emirate, I decided to do what millions of visitors have done over the past decade: Go to a shopping mall. Dubai reportedly has more shopping malls per consumer than any other city in the world, and day or night they are packed with the kind of crowd one typically finds in Dubai: veiled Saudi women browsing Victoria's Secret; teenage Emirati boys in ghetto gear flirting with eastern European girls in black leather miniskirts; Senegalese and Egyptian and Iranian and Kazakh and Korean

families, strolling amid the fountains and stores as Western pop music, globalization's soundtrack, plays over the loudspeakers. At one mall, the Hamarain Center, the theme song to *Titanic,* by Céline Dion, was played so often that local retailers complained.

I chose the Mall of the Emirates, one of Dubai's newest megamalls, a 2.4-million-square-foot behemoth that features an indoor ski slope. Entering is like crossing the threshold into an alternative reality: a lavish, artificial world of high-end clothing boutiques, edgy music stores, cafés, and restaurants that culminates at a massive, plate-glass window with ski lifts in the distance. I joined the crowd at the window to watch skiers descending a snow-covered "mountain," children throwing snowballs at each other, and instructors guiding beginners through their first runs.

I spotted what looked to be a group of Dubaians on a family outing. A middle-aged Arab man in a rented overcoat walked gingerly through the snow in street shoes. Nearby, a woman in a black *abaya,* also wearing a rented coat, nervously held the arm of an Asian woman, perhaps her Filipina housekeeper. A teenage boy with a wispy mustache approached them, skis strapped to his feet. He chatted for a moment, then labored off toward the lift for another run. The woman let go of the Filipina and took a few steps. Then she smiled, squatted down, and picked up some snow, a small white miracle in the desert of Arabia. She seemed to be enjoying herself. The temperature of the real world outside was 110 degrees, but in the dream world of Dubai it was just about perfect. □

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flight of fancy

photographs by Luis A. Mazariegos

STEELY-VENTED HUMMINGBIRD

Vivid as the flowers that fuel their hovering flight, hummingbirds, such as this species in Colombia, do more than dazzle the eye. Beneath the pretty plumage these tiny dynamos are marvels of micro-engineering.

SAUCEROTTIA SAUCERROTTEI SAUCERROTTEI, 8-11 CM

BOOTED RACKET-TAIL BELOW
LONG-TAILED SYLPH

Gaudy tail feathers help these males from South America's Andes attract mates. Like flashy jewelry that advertises a person's earning power, grand plumage may signal robust health and a surplus of energy. Puffs of downy leg feathers (below) are more than decorative, insulating thin legs during frigid nights high in the mountains.

OCREATUS UNDERWOODII, 11-15 CM
AGLAIOCERCUS KINGI MOCOA, 16-19 CM

COLORFUL PUFFLEG LEFT
GREEN HERMIT

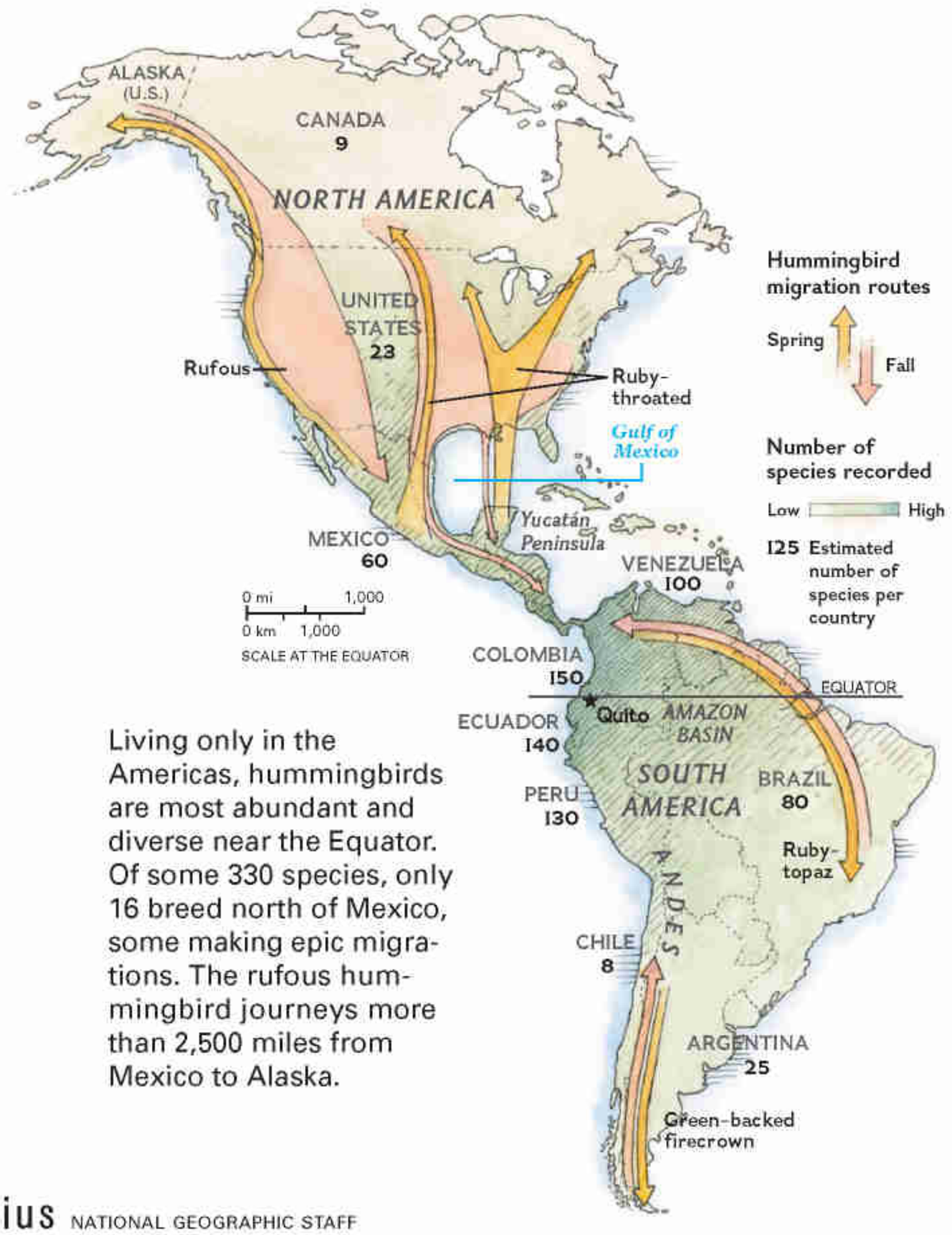
Blossoms bright as Christmas lights lure hummingbirds hungry for nectar, which can make up 90 percent of their diet. In exchange, the birds provide a vital service: delivering pollen to distant flowers. Like many insects, hummers too can see ultraviolet light, perhaps using it to find nutritious plants.

ERIOCNEMIS MIRABILIS, 8-9 CM
PHAETHORNIS GUY, 13 CM

VELVET-PURPLE CORONET

Royal hues adorn the crown and breast of this male from the northern Andes. The iridescence may attract females. It arises from microscopic, air-filled platelets in the feathers, which split sunlight into its component colors, then reflect only certain wavelengths.

BOISSONNEAUA JARDINI, 11-12 CM



Living only in the Americas, hummingbirds are most abundant and diverse near the Equator. Of some 330 species, only 16 breed north of Mexico, some making epic migrations. The rufous hummingbird journeys more than 2,500 miles from Mexico to Alaska.

by Michael Klesius NATIONAL GEOGRAPHIC STAFF

A flash of sapphire, a flutter of wings, and the tiny bird—or was it an insect?—vanishes, the briefest mirage. Moments later it reappears, this time at a better angle. It's a bird all right, a thumb-size dervish with hyperkinetic wings that can beat 80 times a second, producing the faintest hum. Tail feathers paddle, steering gently in three dimensions. As the bird stares into the trumpet of a bright orange flower, a thread-thin tongue flickers from its needle beak. A sunbeam glances off its iridescent feathers, the reflected color as dazzling as a gemstone hung in a sunny window. Little wonder hummingbirds inspire heartfelt affection and stuttering efforts at description. Even reserved scientists can't resist such words as "beautiful," "stunning," and "exotic."

A greater wonder is that the seemingly fragile hummingbird is one of the toughest beasts in the animal kingdom. Some 330 species thrive in diverse and often brutal environments: from Alaska to Argentina; from the Arizona desert to the coast of Nova Scotia; from the lowland forests of Brazil to the 15,000-foot-plus snow line of the Andes. (Mysteriously, the birds are found only in the New World.)

"They're living at the edge of what's possible for vertebrates, and they're mastering it," says Karl Schuchmann, an ornithologist at Germany's Alexander Koenig Zoological Institute and the Brehm Fund. Schuchmann knows of a captive hummer that lived 17 years. "Imagine the durability of an organism of only five or six grams to live that long," he says. Its cranberry-size heart, which averages 500 beats a minute (while perching!), would have thumped four and a half billion times, nearly twice the total for a 70-year-old person.

Yet these little birds are durable only in life. In death their delicate, hollow bones

MAP BY JOHN BURGOYNE AND NGM MAPS. SOURCES: *HANDBOOK OF THE BIRDS OF THE WORLD,* VOL. 5; SHERI WILLIAMSON, SOUTHEASTERN ARIZONA BIRD OBSERVATORY; KARL SCHUCHMANN, ALEXANDER KOENIG ZOOLOGICAL INSTITUTE; F. GARY STILES, UNIVERSIDAD NACIONAL DE COLOMBIA

almost never fossilize. This was one reason for the astonishment that greeted the recent discovery of a jumble of 30-million-year-old fossil bird remains that may include an ancestral hummingbird. Like modern hummers, the fossil specimens had long, slender bills and shortened upper wing bones topped by a knob that may have let them rotate in the shoulder socket for hovering flight.

The other surprise was where the fossils were found: in southern Germany, far from modern hummingbird territory. To some scientists, the discovery shows that hummingbirds once existed outside the Americas, then went extinct. Or maybe the fossils weren't true hummingbirds. Skeptics, including Schuchmann, argue that other groups of birds evolved hummingbird-like characteristics many times through the eons. True hummingbirds, says Schuchmann, evolved in Brazil's eastern forests, where they competed with insects for flower nectar.

"Brazil was the laboratory for the prototype," he says. "And it worked." Hummingbirds became nature's micro-engineering masterpieces, perfecting their hovering ability tens of millions of years ago to compete for a share of the New World's flowers.

"They're a bridge between the insect and bird worlds," says Doug Altshuler, who studies hummingbird flight at the University of California, Riverside. Altshuler has examined hummingbirds' flapping motion and observes that the electrical impulses that drive their wing muscles look more like those of insects than those of birds, which may explain why hummingbirds produce so much power per stroke—more, per unit mass, than any other vertebrate. Altshuler has also analyzed their neural pathways, which function with the lightning speed of the most agile birds, such as their closest cousins the swifts. "They're amazing little Frankensteins," Altshuler says.

They are certainly fearsome—gram for gram, perhaps the most confrontational players in nature. "I think the hummingbird vocabulary is a hundred percent swear words," says Sheri Williamson, a naturalist at the Southeastern Arizona Bird Observatory. Their aggression stems from fierce territorial instincts shaped by their need to sip nectar as often as every few minutes. Hummingbirds compete by challenging and bullying each other. Face-to-face in midair, they post up and pirouette, dive to the grass, and paddle backward in dances of dominance that end as suddenly as they begin.

These battles are best observed in mountains, especially tall ones near the Equator that offer rich ecosystems at a variety of elevations. Williamson suggests that the north-south orientation of mountain chains in the Americas also creates favorable migration highways with a constant source of flowers. Compare that, she says, with natural barriers in Africa that stretch east to west, such as the Sahara and the Mediterranean Sea.

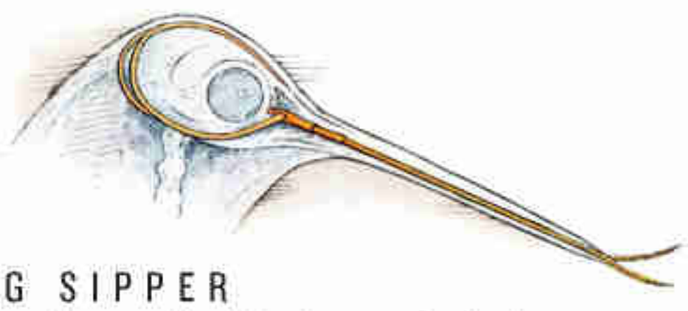
A few hummingbird species, however, have adapted to crossing vast, flat expanses where food is scarce. Before their daunting spring migration to the United States and Canada, ruby-throated hummingbirds gather in Mexico and gorge on insects and nectar, storing fat and doubling their weight in a week. Then they launch across the Gulf of Mexico, flying nonstop for 20 hours and 500 miles to the far shore.

Ninety-five percent of the world's hummingbird species occur south of the U.S.-Mexico border. In the first moments out of the airport in Quito, Ecuador, you might be greeted by a sparkling violet-ear with iridescent splashes of war-paint purple on its cheeks. East of the city in the highest reaches of the Amazon watershed, the swordbilled hummingbird floats amid dense greenery, hoisting the longest bill of any bird for its body size—more than half the animal's total length. On the slopes of Cotopaxi, a volcano south of Quito, the Ecuadorian hillstar has been spotted above 15,000 feet. There it spends the night in caves and enters torpor, curbing its metabolic rate enough to avoid starving before dawn. Later, warmed in sunlight, the hillstar powers up and resumes feeding.

"You can't learn about hummingbirds and not get sucked in," Sheri Williamson says. "They're seductive little creatures. I resisted them, but now I've got hummingbird blood pumping through my veins."

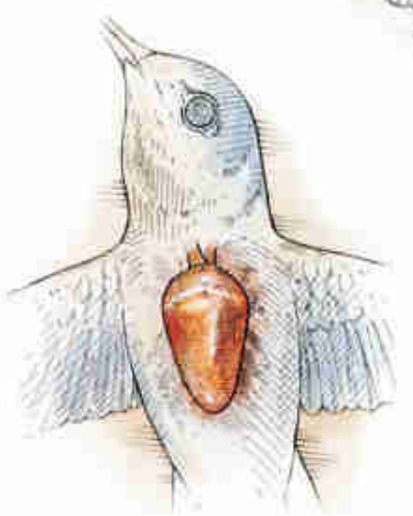
Internet Extra View close-up video of hummingbird behavior, and see a Photo Gallery of additional images by Luis Mazariegos at **ngm.com/0701**.

LEAST AND GREATEST
Weighing less than two grams, the bee hummingbird of Cuba, shown life-size below, is the smallest of all hummingbirds. It is superimposed on the largest species, the 23-gram giant hummingbird, sometimes seen above 15,700 feet in the Peruvian Andes.



BIG SIPPER
Most hummingbirds use their long, slender bills to take in more than one and a half times their body weight in nectar each day. The tongue, forked and trough-like for optimal lapping, flickers up to 13 times a second. It divides at its back end, where it loops around both sides of the head and attaches to the skull between the eyes.

RUGGED WING
Seven-tenths of a hummingbird's wing consists of handlike bones with fused joints for strength. The upper wing bone can rotate more than 180 degrees in the shoulder socket, enabling hummers to hover and instantly change direction. The smallest hummingbirds can flap 80 times a second and rev to almost 100 in short bursts.



STOUT HEART
The hummingbird heart accounts for about 20 percent of body volume, a higher proportion than that of any other animal. Averaging 500 beats a minute while perching, the heart can spike to more than 1,200 beats during high-speed chases with other hummingbirds. It's a flexible muscle, able to power down during periods of cold or scarce food, beating just 30 times a minute until conditions improve.

SWALLOW-TAILED HUMMINGBIRD LEFT
BLACK-THROATED MANGO

In contrast to a vivid male (left), a female (below), which raises the young alone, relies on muted colors for camouflage from predators when nesting. Despite their adroitness aloft, hummingbirds spend almost 80 percent of their lives perched.

CAMPYLOPTERUS MACROURUS, 15-17 CM
ANTHRACOTHORAX NIGRICOLLIS, 11-12 CM

GREAT SAPPHIREWING

Hummingbird wings are driven by the most powerful muscles per unit mass of all vertebrates. The wings of this high-altitude species are unique for their iridescent blue feathers and their size: Thin Andean air requires larger wings and fuller strokes.

PTEROPHANES CYANOPTERUS, 19-20 CM

BROWN INCA

A leisurely backstroke brings a bird within easy reach of a row of blossoms, among some 1,000 flowers visited each day. With a backflip, the hummer dashes off. Such glimpses cast a spell. Says naturalist Sheri Williamson, "They're such brave, dynamic little creatures." □

COELIGENA WILSONI, 11-13 CM

Arctic Dreams & Nightmares

With only a headlamp and the mid-February moon to light the way, Mike Horn treks across pack ice on the Arctic Ocean. He and teammate Børge Ousland were pursuing a shared vision: to ski to the Pole in the dead of winter. Not long after, a third adventurer—stranded, frantic, and alone—sat atop a shrinking ice floe facing death.

By Marguerite Del Giudice

BØRGE OUSLAND

Cocooned in a buoyant dry suit, Børge swims through a slushy gap between floes, an often repeated ordeal that could take up to an hour. At minus 30°F, the air was much colder than the water, Børge says. “I was sweating inside the suit.”

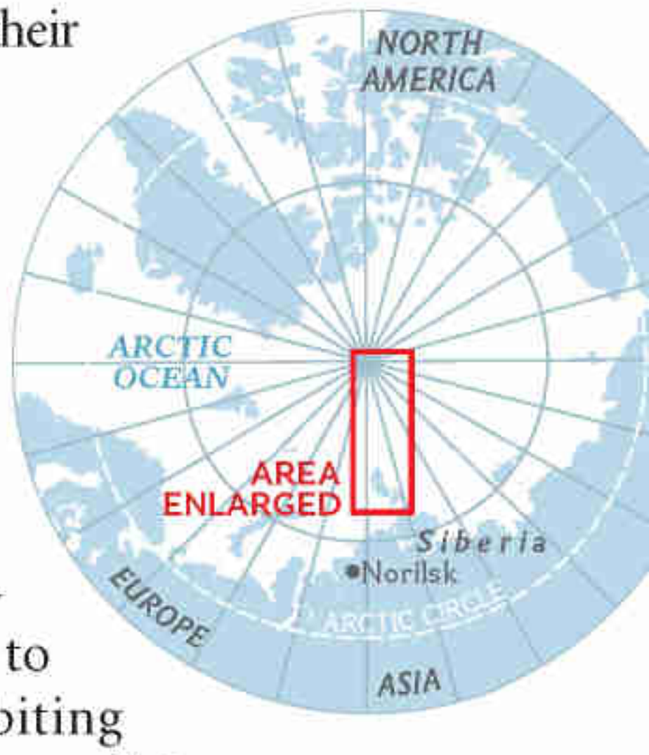
MIKE HORN

Spooky. That's the word that keeps coming up when people describe Cape Arkticheskiy, the godforsaken tongue of land where this Arctic adventure tale begins. There's nothing there but the ice, moaning like an old door in the wind, and hungry polar bears looking for lunch—which, on any given day, if you are not careful, could very well be you. (That's why you pack the .44 Magnum.) This desolate dot on the top of the planet is like any other Siberian outpost, except for one thing: It's the start point for some of the most ambitious Arctic expeditions and extreme explorers of our time, one of the places where the pros separate themselves from serious amateurs and adventure clowns.

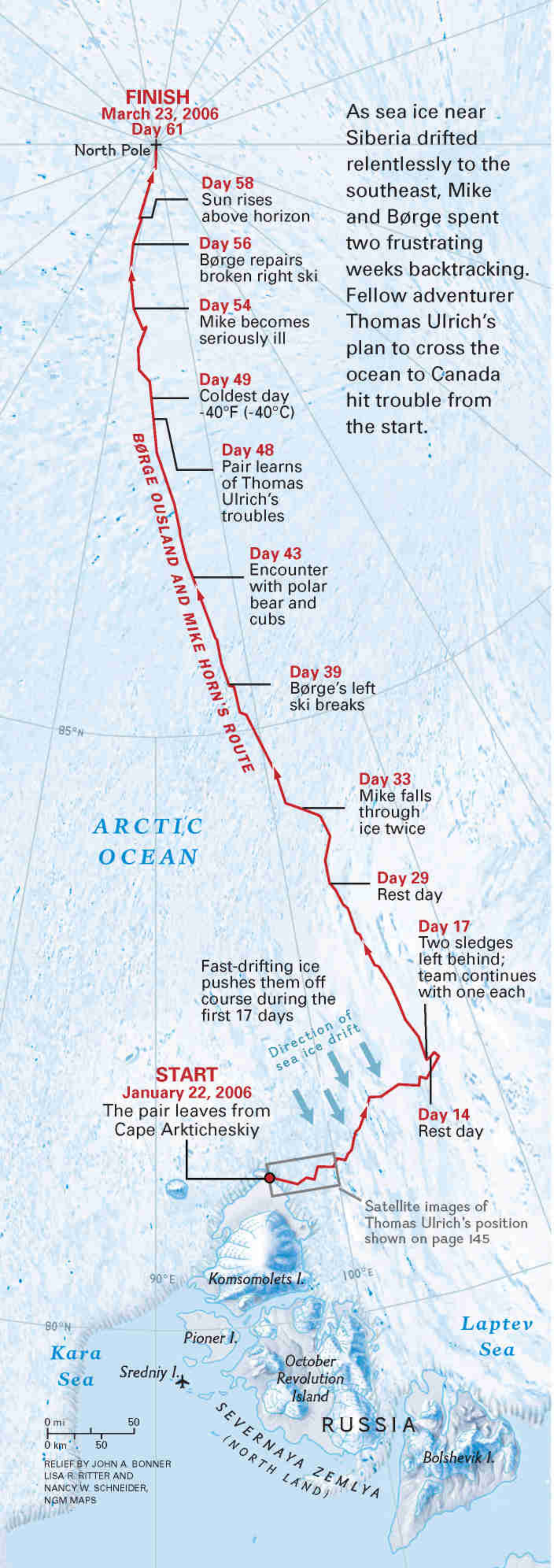
The tricky part is getting off the cape and onto a more solid surface to walk to the North Pole. Depending on the weather, that first step can either be more or less a breeze or a death trap. Sometimes the ocean surface freezes all the way up to the shoreline, and sometimes there are miles offshore of unstable, drifting ice and open black water that, in 2004, swallowed one able French adventurer, Dominique Arduin, without a trace. It's not uncommon to end up being flown across the hard part or picked up as a nervous wreck.

In the early months of 2006, six expeditions planned to set out from Cape Arkticheskiy. One solo adventurer crapped out altogether, as soon as he got a load of it, and three other parties were airlifted by helicopter to a safer chunk of ice. Two expeditions remained: The team of Børge Ousland and Mike Horn, who were navigating 600 miles to the North Pole—in the darkness of polar winter—and Thomas Ulrich, who wanted to cross the Arctic Ocean, 1,200 miles from Siberia to Canada, later on with daylight but alone.

Børge, 43, lankily erect, fair-featured, and self-possessed, with long, ropy arms and cinnamon hair, was known, among other things, for his obsessive preparedness; he was a study in Nordic cool. Mike, 39, a dark-featured, dimpled South African-born Swiss, tightly muscled and with gigantic thighs, had a zesty kinetic spirit that gave the impression of a bull in a china shop; he thought of himself as a hot Latin and was more inclined to wing it. You could see the stamina shining out of his eyes. Thomas, 39, a compact and talkative Swiss, quick to laugh, with twinkly blue eyes and an underlying edge, was fastidious about safety and had a professional alpine guide's love of detail. At one point, he was a prospective third partner on Mike and Børge's trek to the Pole in the dark, but, for reasons which will be explained later, they went their separate ways.



This is how they went about things: Both expeditions were unsupported. No dogsleds or airdrops of equipment or food or fuel along the way. They had to be as prepared as was humanly possible for circumstances that promised to be wildly unpredictable: biting headwinds and whiteout conditions, 40-below temperatures, polar bears, pack ice, open water. The ice often presents itself as a mosaic of islands, separated by canals of water. These canals are called leads, and leads can be a big part of an Arctic explorer's life. When you come to one, the first thing you do is look for a crossing where the two ice fields meet; otherwise you have to hop across, paddle across in an



As sea ice near Siberia drifted relentlessly to the southeast, Mike and Børge spent two frustrating weeks backtracking. Fellow adventurer Thomas Ulrich's plan to cross the ocean to Canada hit trouble from the start.

inflatable rubber dinghy (if it's really far), or swim across in a waterproof suit, a big one-piece polyurethane thing that fits over your clothing and boots and traps air in such a way that you float: Børge's invention.

They did their walking on skis, and dragged anything they might need behind them. Each man wore a harness, and the harness was roped to two single-file capsule-shaped sledges weighing a total of several hundred pounds that would get gradually lighter as they used up supplies. The sledges could float and had runners for the snow. Their gear included tents, stoves, sleeping bags, and vacuum-packed food, of course, the inflatable dinghies and waterproof suits, and also flare guns, the .44 Magnum revolvers, satellite phones, backup batteries, pocket PCs, and global positioning system (GPS) units. Mike and Børge had lithium-powered headlamps to light their way in the dark. They were all working with the same Russia-based expedition planner, Victor Boyarsky, and every day, a guy in Switzerland, Hans Ambühl, passed on information about weather conditions and how things looked up ahead, based on satellite images provided by the Canadian Space Agency.

So this is who they were and what they were doing up there. Børge and Mike set out together first, in the dark of January. Thomas followed alone, in March.

This is their story.

The first step is always like this

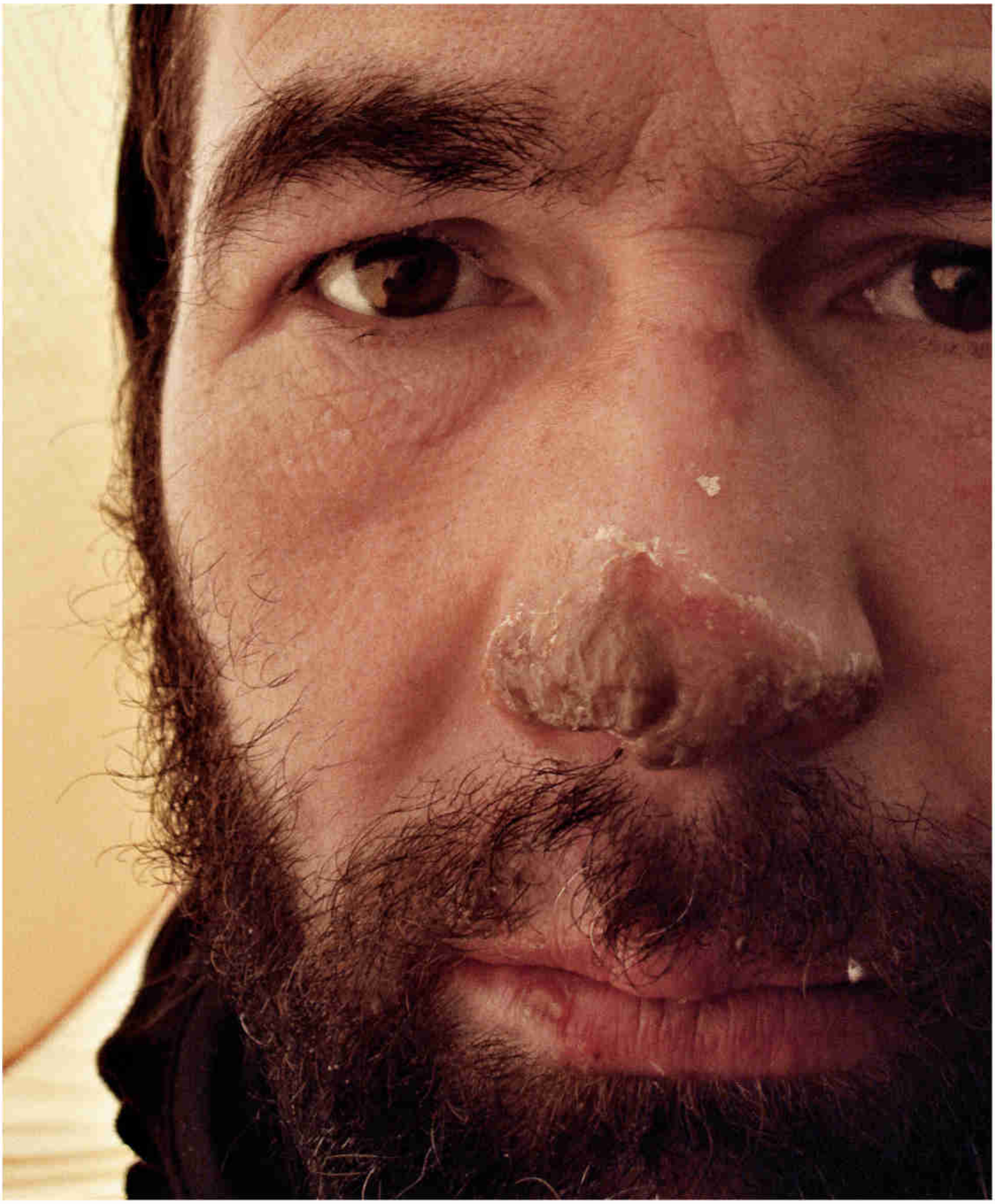
Explorers will tell you that—in an extreme wilderness like the Arctic Ocean, which is still among the least explored places on Earth—your life is in danger from the moment you take your first step, and after that it's only a matter of how much in danger. Such was the case with Børge's and Mike's first steps in and around Cape Arkticheskiy in the pitch dark of polar winter.

They tried to get going right after the helicopter dropped them off there but encountered a wall of ice at the coast, moving past them sideways in the wrong direction. So they spent the night, scared in their tent but happy that at least there were two of them. Then Børge heard something.

"Mike, is that you?"

"If you worry, you die.
If you don't worry, you also die.
So why worry?"

—MIKE HORN



Frostbite took a piece of Mike's nose, despite his daily regimen: He coated his skin with his own mucus, which froze into a protective layer. His nose later healed.

MIKE HORN

"Yeah, I'm chewing on a piece of chocolate."

Then came a ripping sound—*fwaap!*—followed by the head of a polar bear. Mike and Børge lurched backward, which scared the bear; it ran off with some food, and they had to chase after it firing the flare gun, to get the food back.

When it came time for bed, Mike assured Børge that he was alert, jungle savvy from previous expeditions, months kickboarding down the Amazon and walking around the Equator; he knew all the sounds. That said, he immediately fell fast asleep and started snoring. Børge was wide awake all night.

"Mike, how can you sleep?"

"Børge, if you worry, you die. If you don't worry, you also die. So why worry?"

The next night, the tent was flapping so noisily in the wind that they didn't hear a polar bear dragging away their rubber boat. They found it the next morning, a hundred yards away, all chewed up, and had to spend hours repairing it. Two nights, two bears.

They took a walk to check out the ice. Hans was telling them that the ice, based on the satellite images he was analyzing back in Switzerland, appeared to be drifting fast to the southeast—the wrong way—at a rate of half a mile an hour. But they were already so tired of polar bears that when they found a good crossing off the cape and the drift seemed to calm down, they decided to get the hell out of there.

They had to use the patched rubber boat to cross some treacherous leads and get away from the coast and ended up camping for the night a couple of miles out. When they woke up, they found they had drifted nine miles backward.

That's how things went for the next couple of weeks, with everything around them opposite from what it was supposed to be. Instead of frigid weather, they got a Siberian heat wave—temperatures in the teens and twenties. Instead of minimal wind, it was harsh, blowing the wrong way, and in their faces. Instead of the ice drifting in a direction that would help them, the floes were carrying them away from the Pole. Day after day, they'd march north, then slip toward Siberia while they slept; it was all they could do to hold their position.

There were only so many weeks before the midnight sun would rise over the horizon and deliver its six months of continuous light to the region. The plan was to get to the Pole before that, but they'd never make it at this rate; they'd run out of food. So they started walking longer and eating less and, consequently, having distracting food fantasies: blueberry crepes with sour cream for Børge and chocolate-covered marshmallows for Mike.

In the beginning, they swam a lot—up to five or six times a day—across canals of water between islands of ice. "We just swam, swam, swam, got out, swam, and kept going north," Mike says. This entailed taking off their skis, packing them up, maneuvering themselves, in all their heavy clothing and boots, into the zippered waterproof suits, sliding very carefully into the water so none would seep in at the neck, then dragging in their sledges, which together weighed, at the start, 340 pounds. Sometimes they had to break up thin ice on the surface before sliding in. The water was warmer than the air, the sledges could float, and the waterproof suits were buoyant; but still, here they were, "out there in pitch-black water with just a headlamp and these towers of ice moving around," Børge says. Sometimes unable to see either where they were swimming or the sledges they were pulling behind them. "We felt a little bit like Laika in space"—the dog the Soviets sent up. On another planet. It was scary.

When they weren't in the water, they were skiwalking in what felt like a tunnel, everything whited out from the snow except the dimmed cone of a few yards of light from their headlamps. They navigated through thick snow and flat ice fields and pack ice, which is frozen salt water that has broken up and jammed together into varying piles of giant ice cubes.

It wasn't practical to rely solely on the GPS, because it consumed too much battery power, and the display tended to freeze up and had to be warmed up in their pockets. They'd check it once in a while but mostly navigated by wind direction (in part determined from the flapping nylon telltales attached to their ski poles), the moon and stars, and, in particular, Mike's mastery in reading drift patterns in the snow. He had learned "the old way," he says, from an Inuit in Canada's Foxe Basin, named Simon, who "taught me all the different ways snow looks." Falling snow, drifting snow, blowing snow; knee height, shoulder height, head height. A drift starts at the level of the ice, and, as the wind gets harder, the drift gets higher. The higher the drift,

The tent was flapping so noisily in the wind that **they didn't hear a polar bear** dragging away their rubber boat.

the higher the wind speed. Wind speed, in turn, indicates how fast the ice will be moving and how fast it might break up. Mike could follow the wind-hardened ridge of an old drift with the tip of his ski, and in this way the two men tapped their way north in the dark.

Sometimes it was all they could do to keep their eyes focused on the ends of their skis, the next hour, the next minute, the next yard, because it wouldn't do any good to think ahead. It was that rarest of experiences—living completely in the now. *Where am I? What must I do? Can I still feel my fingers?* Sometimes they were happy just to find themselves alive in the tent at the end of the day.

Why are they doing this?

This kind of hell, of course, was exactly what they were looking for. These guys are professionals. They have sponsors—outdoor gear manufacturers, construction outfits, an adventure travel agency, a watch company—and their livelihoods involve doing extreme adventures. They didn't set out for things to fall that way; they were just doing what they loved. But after discovering they could earn a living—writing books, taking pictures, making films, and especially motivational speaking—by following their hearts, what was not to like?

Each had been adventuring since boyhood, practicing at taking incrementally higher and higher calculated risks, and at some point they left their comfort zones and never went back. For them, going to extremes that may seem insane was actually a logical progression.

You don't go to the North Pole in the dark as a first adventure, for instance; you start, as Børge did, growing up skiing and roaming the mountains of Norway. You start your life, get some kind of job. He worked as a diver for an oil company. Wore a copper helmet and big lead shoes and lead weights on his back and chest. Graduated to the depths of the North Sea, sometimes working for weeks at the bottom in a pressure chamber, inspecting oil rigs and working on pipelines. In between, he spent a couple of years in the Norwegian Navy, as a diver with the special forces. He loved training. His first expedition was a trek across Greenland with a couple of diver friends 20 years ago, before GPS and satellite phones. They relied on sextants, cotton, wool, and other equipment similar to that used by Fridtjof Nansen and Roald Amundsen, the great Norwegian polar explorers of yesteryear and Børge's countrymen, in whose large footsteps he follows. That's when he got the bug. On this trip, he was wearing boots that were replicas of the ones Amundsen wore on his 1911 trek to the South Pole.

In Mike Horn's case, the pivotal point in his life, he says, came when he impulsively left his hometown of Johannesburg, South Africa, and moved to Europe. A gifted athlete, who ran track and triathlons and played competitive rugby, he dreamed of competing internationally, maybe the Olympics. But South Africa, shunned by the world community at that time because of apartheid, was not allowed. At 18, he was drafted by the South African Army to fight a communist insurgency in Angola as a commando. Afterward, he went to college, then worked in his uncle's fruit and vegetable business. But the monotony got to him, and he longed to see the world. So he decided to give his stuff away and get on the next plane to the first country that would have him—Switzerland—where he took a job washing dishes in an old hotel. He learned to ski (he'd never seen snow before that) and became a ski instructor, then rafting guide, and paraglider (venturing to Peru and crashing near Machu Picchu). After swimming the Amazon for five months with a kickboard, he became an adventurer full-time.

Thomas Ulrich, whose expedition we'll get to later, grew up in the mountains around

Børge's headlamp glows in the bitter darkness as he stands by the tent. Inside, togetherness sometimes turned into quiet sparring. Børge said Mike walked too fast. Mike felt Børge was bossy. "But polar exploration is his life," says Mike. "I was there to learn."

Interlaken, Switzerland, hiking, camping, alpine skiing, and racing. He was rock climbing and paragliding (at one point, he worked as a test pilot for a manufacturer) before the world at large knew much about paragliding. People would ask, why are you doing that? Or say to his parents, hey, you might want to check out your kid here. He seemed extreme. He worked some as a carpenter but felt bored and restless. He would take pictures during his mountain adventures, and one day he sent one to a magazine and the editors published it. That's when he first realized that he might be able to make money doing what he loved. He took an international mountain guide course and started a paragliding school while continuing to build an adventure photography business. When he was about 18, he took his first of many trips to Patagonia, to climb an 11,000-foot tooth of rock called Mount Fitz Roy, and that was the trip—the preparation, especially, the new culture, living in a tent—that propelled him into the world of extreme exploring.

The idea that these men have a death wish seems to amuse them. It isn't a desire to be closer to death that attracts them, they will tell you—it's a desire to be closer to life. They've been to the mountaintop. They know that willpower can be built, that ordinary people, like themselves, have abilities beyond their reckonings. They're just the ones who are out there, scouting the wilderness on behalf of the rest of us. Not marking dots on a geographical map anymore—that was accomplished long ago. What they're exploring now is the inner map, the mental and emotional map. What will they learn, about themselves, from being in a position where nothing matters except to stay alive? What, exactly, is the human being capable of? This is what drives them.

Oscar, meet Felix. Felix, meet Oscar.

For Mike and Børge, the expedition was turning out to be as much interpersonal as geographical. The men—two alpha males sharing a tent—had to figure out how to get along. They had been virtual strangers beforehand. Then, on the trip, they couldn't see each other's faces in the dark, couldn't read each other's reactions, and the headlamps shone awkwardly in their eyes. A simple misunderstanding, after a bone-tiring day fighting to stay alive, could escalate

BØRGE OUSLAND

Sometimes they were happy just
to find themselves alive
in the tent at the end of the day.

Mike soldiers through a whiteout that reduced visibility to a few feet. "It was like we were blind," recalls Børge. "We were just feeling our way forward."

BØRGE OUSLAND

unpredictably and require energy neither could afford. So in the beginning, they kept their differences to themselves, sitting on their own sides of the tent at the end of the day, cleaning their gloves and shoes, with their backs to each other.

One of their issues had to do with defecating in the tent, what was acceptable and what wasn't. Mike had brought along a "multipurpose" insulated aluminum pot that could be used both as a cooking pan and a toilet, a system he had previously used in the Arctic. He'd line it with a plastic bag, sit on it, do what he needed to, take the bag out, the contents would freeze, he'd empty them out, and the bag would be completely dry; he thought it was brilliant. But Børge said no to that. Going to the bathroom in the tent, something he had not done before, would be all right, he supposed, as long as he and Mike went at different times, but you certainly didn't go in the same pot you boiled your water and cooked your meals in, no matter how many plastic bags you lined it with.

Børge also liked to follow strict regimens, which had served him spectacularly well in his extensive polar experience. He was fussy about the equipment, how breakfast was prepared, how the tent went up and down. The margin for error in a place like this was virtually nil; any lapse could be fatal. Mike, meanwhile, was grateful to have Børge's polar expertise at his side. The expedition had been Børge's idea, and Børge was the boss. But Mike, accomplished as well and accustomed to exploring alone—emotional, proud, and stubborn—was inclined to bristle at being told what to do or how to do it. One evening, after a particularly long and tiring day, a pole snapped while Mike was putting up the tent, and Børge accused him of being careless. (Repairs were Børge's job, and rethreading the drawstring inside the tent pole had to be done with bare hands in the cold, Børge's bare hands, because Mike's had been frostbitten on a previous expedition and were too vulnerable to expose.) Mike felt sure he hadn't forced anything—the pole just wasn't holding up to the elements—and took offense.

Here they were: the Arctic odd couple, alone together on the ice.

After that episode, the two men sat down in the tent for a gentlemanly tête-à-tête. Mike told Børge he had a lot of respect for him but didn't always agree with how he explained himself or

felt things should be done; he came off as rigid and sometimes arrogant. Børge explained that the Scandinavian culture was one of few words. Norwegians don't say "I'm sorry" all the time, for instance. They just go about their business, correctly and in silence, and expect others to do the same. Remarks Mike had experienced as criticism, Børge had intended as advice. In the end, they realized that their main problem had been poor communication and pledged to be more open with one another.

Børge finally accepted a cup of Mike's coffee, they swapped meals (precooked, ground-up, freeze-dried, and vacuum-packed things like potatoes, chicken, beef, lamb, reindeer; each had his own menu). They even reached a compromise on the toilet issue: Mike had his door between the inner and outer tent, and Børge had his. Sometimes, one of them would make a scatological joke, and they'd share a little laugh. The two men learned to appreciate these moments, because the rest of the time, they knew, they were going to suffer.

Just the usual polar despair

After a couple of weeks, the wind shifted, and they finally found themselves headed steadily north with the wind at their backs. All they had to deal with then were the usual hazards associated with doing what they were trying to do in the dark: Walking blindly in whiteout conditions, unable to discern the terrain. Negotiating a compression zone where mountains of ice six yards high blocked their path. Crossing a 400-yard lead covered in thin ice by donning their swimsuits and crawling. Mike's thumbs were frozen, and Børge was stuffing hot-water bottles in his boots to keep his feet thawed.

After six or seven weeks, the sun, while not yet risen, was close enough to the horizon to light up the landscape, and they didn't need their headlamps anymore. The North Pole was in their sights, two or so weeks away, when Børge started getting disturbing text messages on his satellite phone about Thomas Ulrich. Remember Thomas? He had just set out from Cape Arkticheskiy, intending to cross from Siberia to the Pole and then on to Canada. Børge had talked to him by phone to say that ice and wind conditions ahead were good. But the text messages now were indicating that something had gone wrong and Thomas was drifting in strong winds. Børge tried to call to offer moral support, but Thomas's phone was either turned off or in use. Børge knew how difficult it was getting past Arkticheskiy's coastal turbulence. But he didn't think it was anything serious, just the usual polar despair.

Sometimes it's better to just stay in the tent

Thomas's life was in peril almost from the moment he stepped off the cape. First of all, he'd had to spend five restless 30-below nights alone on Arkticheskiy, waiting for ice to form off the coast so that he'd have something to ski-walk on, and watching out for polar bears. One had already come sniffing around his equipment, and he'd had to scare it off with a signal flare.

Finally he got some encouraging news from Hans, his home-based expedition manager, the lean, sensitive egghead who was interpreting satellite images back in Thomas's hometown of Interlaken, Switzerland, for him as well as for Børge and Mike. The pictures were showing a small window of opportunity—six miles of suspicious but traversable ice offshore, which could be covered, theoretically, in one day—so he bit. A favorable north wind was being predicted that could blow the good ice closer to the coast and close up the leads, and he figured that, if conditions turned out worse than expected, he could always come back to the coast. So he put on his skis and set out, early on a Wednesday morning in March, towing two yellow sledges weighing a combined 375 pounds.

The going at the start was relatively easy. But the leads off the coast had opened up overnight, and the best one he could find was at least a hundred yards across. The ice on the other side appeared older and more stable, so he inflated his rubber dinghy and started paddling. A thin layer of ice soon stopped him, and he had to slip into the water in his waterproof suit. Breaking the ice with his body while dragging the sledges behind, he injured his groin. On the other side, the ice turned out to be disappointingly thin and surrounded by water, and he found himself on an island about the size of four football fields. He would have retreated to the cape, but the wind kept pushing the ice he was on farther from shore, and him with it. Not good, but having no other options, he camped for the night.

In the morning, a strong northwest wind

He vacillated between panic and calm.
Screaming, swearing, crying, praying, and then getting back to work.

was blowing his mosaic of ice southeast at an unpleasant pace. He was riding in an area of swiftly drifting patches of ice, and he was on one of those patches. At this point, he was thinking he might have to be evacuated and restart his expedition. But he wasn't scared to death or anything. Then the storm hit.

Two years he'd spent preparing for his big moment, organizing the gear, raising $250,000 from sponsors, getting in shape by dragging car tires behind him on mountain trails in the Swiss Alps. Now look at him: huddled alone in his tent, making frantic calls on his space-age phone to Hans in Switzerland and Victor in Russia, who were trying to come up with a plan. He had been only a couple of miles off the coast when the storm hit. *How could they not see it coming?!* There wasn't even any snow to weigh the tent down with—he'd had to use food bags—and if he opened the door the howling wind was going to inflate it like a balloon and catapult him into the sky. Every now and then it insinuated itself underneath, and he could feel himself hovering momentarily over the ice, like a flying carpet revving its engine. The only thing keeping the tent on the ground was the weight of his body, and all he could do was sit there, trying to be heavy.

What am I doing here? All he could think about were his wife and daughters. *How could I do this to them?*

The yellow walls of his tent were covered with family drawings: the Easter Bunny, a bonfire, his hammock, and, oh, yeah, some angels. Here was a guy who believed that when your number's up, it's up—"They put you in the cemetery and the worms come"—but he wanted angels. He was imagining his kids crying in the church at his funeral and people talking about what a dope he was and all the stupid things he did in his life. He couldn't just do things "for fun." He couldn't just be a carpenter, as he had trained for, and climb mountains on the side like everyone else in Switzerland. No, he had to climb them intentionally in bad weather, or scale the treacherous Ferrari route of Cerro Torre in Patagonia *during the winter,* or cross Patagonia's Southern Ice Field on foot. That one day he might not return home was always a risk. Now, sitting alone in his tent fighting an Arctic storm, he was wondering if this was that day.

Every now and then he tried to call Børge but couldn't get through. Which was just as well. For one thing, what could Børge do for him? He and Mike were probably suffering, too. For another, Børge was his teacher, as far as polar exploring was concerned—that's who he traversed the Patagonian Ice Field with, over 54 days, in 2003—and he was embarrassed about the pickle he was in. For a third, Thomas originally had planned to go with Børge in the dark to the North Pole. The two had discussed it while in Patagonia, and Børge had told Thomas then that he needed to get more experience first—both Arctic and solo—and that after that the two could go. Thomas was already well into planning that solo trip, when Mike Horn entered the picture. Mike had done a solo circumnavigation of the Arctic Circle, and therefore knew how to get around up there in the dark, something Børge didn't have experience with. After Mike returned, he and Børge got to talking, and Børge invited him in. At first, Børge figured all three men could make the trip, but Mike wouldn't go for it. He didn't want to wait for Thomas to get experience, thought having three would slow the trip down and complicate decision-making (inevitably turning two against one), and believed Thomas didn't bring a skill to the table that either Børge or Mike didn't already have.

Børge had crossed both the Arctic Ocean and Antarctica solo and was the first man, in 1994, to walk to the North Pole unsupported and alone. Mike was famous in Europe for his extreme solo expeditions. Thomas was known mainly as an adventure photographer; he had not really been

The only thing keeping the tent on the ground was the weight of his body, and all he could do was sit there, trying to be heavy.

tested in the Arctic, and he had never gone anywhere solo—a true measure of psychological grit.

Børge was torn and felt bad. But he understood Mike's position, and in the end it was decided not to wait for Thomas, who, confident in his own capacities and not one to slink into the shadows, proceeded with his ambitious plans for an unsupported trans-Arctic trek.

In any event, marooned in the Arctic on a floating piece of ice, Thomas was mortified that his big expedition was going south so fast. It's always a crapshoot when you put yourself at the mercy of nature. (And Børge would say later, "He was just unlucky.") But at that point, Thomas was racked with self-doubt—*Was it bad luck, or did I make a mistake?*—and, on that level, his teacher Børge was the last person he wanted to talk to.

Can it possibly get worse?

So there he was, sitting on the ice in his tent, fighting the storm. It was dark, the ice was breaking up, and the piece he was on soon shrank in size, from four football fields to one. No more staying in the sleeping bag. His boots were on, and he'd fixed a bag to his harness—containing satellite phones, backup batteries, an emergency satellite beacon, three days of food, the stove, a little water—in case all hell broke loose and he had to scramble to another piece of ice. In the middle of the night his rubber dinghy, which was roped to the tent, started flying around, threatening to pull it down, so he cut it loose and watched as it disappeared into the black sky.

He was in frequent touch with Hans, but the satellite images were only so helpful. By the time the satellite finished its orbit and the images were downloaded and processed, they were already four hours old—at best. They also couldn't be transmitted directly to Thomas on the ice, and therefore he couldn't reckon them with what he was seeing with his own eyes.

A strange sensation suddenly gripped him. But he couldn't unzip the floorless outer tent and look, for fear the wind would rush in and blow it away with him in it. So he crawled underneath it. Flying water hit him in the dark, he got soaked.

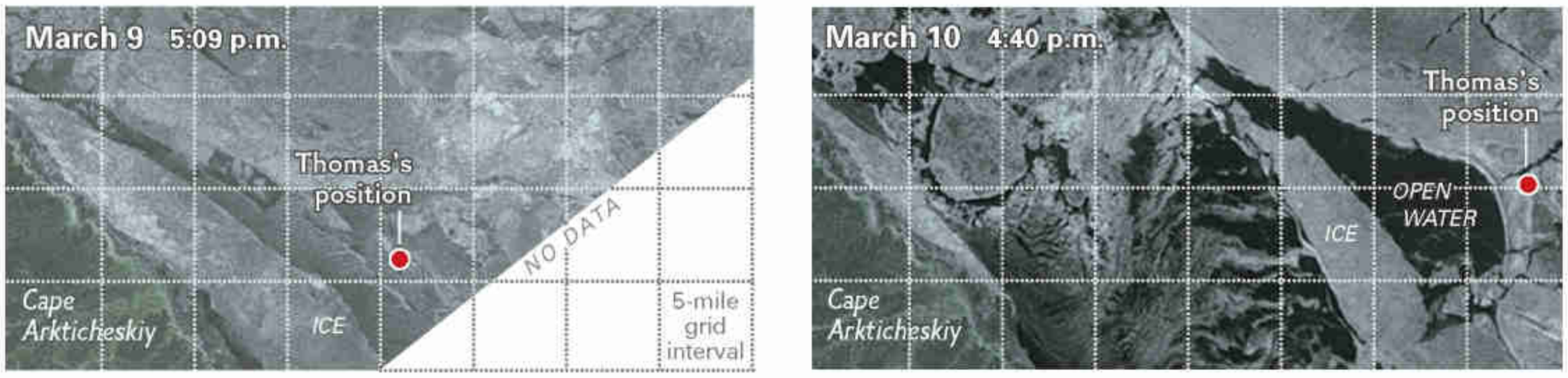
Then he realized what was happening. A yard from the side of his tent, the ice had cracked, and he was undulating near the edge. Then in front of the tent came a second crack, and a third, and then one under the tent. His football field was breaking up completely, and before long he was standing on a piece ten yards square. He activated his emergency beacon then, grabbed his emergency bag, pulled on his skis, and hustled around in the dark, looking for a better piece of ice, bobbing up and down, as if he were on a raft.

Screaming and crying, he called Hans. "I'm dying! I'm dying! You have to get me out of here!"

Meanwhile, back in Russia . . .

The rescue would have to be organized by Victor Boyarsky, Thomas's Russia-based expedition manager and fixer extraordinaire, an accomplished polar explorer in his own right, a man full of humor and confidence and life, and a master at working the Russian aviation bureaucracy. As a director of the Russian State Museum of the Arctic and Antarctic in St. Petersburg, Victor had contacts high and low in the infrastructure, and it was looking as if he would be needing all of them.

Thomas had laid out $140,000 of his own money—a bank guarantee—to ensure easy access to funds in the event that he needed to be rescued. But that didn't mean helicopter rescue crews were standing by 24 hours a day. Two helicopters had originally remained near Cape Arkticheskiy for some days, meaning to hang around until he made it safely off the coast. But the weather was so bad, and Thomas had to wait so long for conditions to improve, that by the time he got



Thomas's nightmare Foul weather—and bad luck—doomed Thomas Ulrich's dream of crossing the Arctic Ocean alone from Siberia to Canada. Conditions went from bad to worse between March 9 (above left) and March 10 (above right), when a storm fractured the ice into ever smaller floes and scattered his food bags (bottom). "There was no safe place," says Thomas (below). "Everything was blown away."

RADARSAT IMAGES BY CANADIAN SPACE AGENCY (TOP); THOMAS ULRICH

started the helicopter crews, for cost reasons, had returned to their base in the city of Norilsk—840 miles away from the cape. Now there were procedures, restrictions, military permits to obtain. It was nighttime, and the helicopter pilots weren't allowed to fly at night. Then the wind kicked up, and they had to wait until morning anyway.

Victor broke the news to Thomas. Make a new camp from the remains of your old one, Victor told him, and try to keep warm. By then the wind had died down and the ice wasn't moving so much—the storm was over for the time being. So Thomas went back to his original camp, dragged his sledges to the new spot, and fixed them together with his skis into a kind of catamaran; that way, he'd have something to sit on in open water, if he needed to. Food bags and other gear had been strewn over the ice in the storm, and a polar bear came sniffing around. He had to fire three live rounds into the ice at its feet before it went away.

He was waiting with his catamaran and his .44 when the light came up, which, of course, allowed him to see farther away, and what he saw was a huge expanse of open water not very far in the distance. It was as if he were sitting on the beach at the seashore. Waves were washing up on the edges of his ice and melting it away. He vacillated between panic and calm. Screaming, swearing, crying, praying, and then getting back to work: watching the ice, checking his gear, keeping warm by the stove.

He still hadn't called his family. His composure was iffy, and he didn't want to frighten them. He didn't think his wife, Åsta, originally a farmer's daughter from Norway, could handle it, and he didn't think he could handle her not handling it.

The view from Switzerland

Back home, meanwhile, Åsta could tell something was up. Thomas had been phoning her every day. Now he was phoning only Hans, and when she spoke to Hans he would say only that something wasn't so good. She could hear him searching for his words. Finally, Christine Kopp, a writer and close friend who had accompanied Thomas to Siberia, spilled the beans to Åsta. Christine called Thomas and told him he had to call his wife, and so he did. When the two finally spoke, he tried to explain: the bad ice, the open water, the sudden storm. He was crying and uncertain if he'd survive the night. Åsta told him there was nothing he could have done, he didn't have to explain. "You use your energy up there," she told him. "Don't worry about us." But after they hung up, she couldn't breathe.

It wasn't long before Thomas's predicament leaked into the media: Swiss Explorer in Race with Death. That sort of thing. The children—Linn, 11, Silje, 9, and Julie, 5—were quieter than usual, as if they didn't want to know more. To protect them, Åsta kept the newspapers away, the radio and TV turned off, and took them to a museum in Bern, called the Sensorium, to distract them from the prospect of their father's death.

No eating, drinking, or sleeping allowed

After the call, Thomas decided he owed his family for their unconditional support: *I'm not allowed to not come home.* Then he did a strange thing. He went to his tent on the old campsite, and, instead of collecting it, he cut out the drawings his family had made on the inner tent wall—a drawing from each daughter and one from his wife. He was doing everything he could to live, but a part of him was preparing to die.

This is what's going to help me now, and this is what I'll take with me if I'm going to die.

A third night out there loomed. The sleeping bag, everything, was wet, and all he had for shelter was the outer tent with no floor. He hadn't slept, and he couldn't afford to. He wanted to eat, but he was out of fresh water and there was no clean snow to melt. He was situated on saltwater ice, and as soon as any new snow hit the ice, it absorbed salt. He'd been using what snow he could glean from the folds of the tent and the tops of the sledges. But the food was too salty and made him sick. On top of everything else, he was suffering from diarrhea.

"I fell asleep," he told Victor during one of their calls. Just for 15 minutes.

"No, no, no, no!" Victor said. "You must not sleep! Call me now, every ten or fifteen minutes!"

Thomas got the Styrofoam box his father had made for him to store his batteries in, a comforting reminder of home, and spent one night and another day sitting on it. Making calls, trying to figure out what he did wrong, and thinking about the meaning of his life.

He still hadn't called his family. His composure was iffy, and **he didn't want to frighten them.**

Arm bending, Russian-style

By then, the rescue helicopters had actually taken off from Norilsk. But it took them eight hours to get to the air base on Sredniy Island, 90 minutes from Thomas's position—and by the time they arrived and refueled, it was night again, and they weren't permitted to fly at night. Getting the pilots on board to rescue Thomas was a delicate matter. Victor was asking them to do something dangerous. But he also knew, from talking to Thomas every 15 minutes, that the weather around him right then was good but might change if they waited too long.

At a certain point, the pilots were willing, but the air company was not. Flying in the Arctic is risky, and Russian pilots are used to that. But managers and bureaucrats don't like to take additional risks, especially if the operation—flying at night—falls outside the rules. Not unreasonably, the air company was reluctant to jeopardize the lives of ten people, two five-man helicopter crews, to save one. Victor spent hours on the phone, cajoling, arguing, explaining, and warning. "If you don't fly, Thomas is going to die. He can only survive a certain amount of time out there, without water, in the cold, without sleep. Anytime, the ice can break and he could go in the water!" He was working the phones like crazy, across time zones and under the dizzying communication constraints of the remote Arctic, waking people up in the middle of the night and pulling every string he had. "Big mess."

In between, Thomas would call and terrorize him over the phone. "Make it happen, Victor. Get me out of here!"

"Give me one hour," Victor told him. "I have to make a few more calls."

Finally, Victor, according to his own account, got through to the "chief" at the air company and made the right argument: Thomas's predicament was all over the news. If he dies, Victor told him, and you have decided not to fly to him because it's dark, you will have to choose your words very, very carefully. The world will be watching.

The next call Thomas got was this:

"Give me your coordinates, they're coming."

Thomas gathered his tent, mattress, and other flammable equipment into a pile and saturated it with fuel. When he heard the helicopters, he shot a flare into the pile, which erupted into a beautiful light. The beams of two choppers came toward him, dipping in and out of the fog, and flew right past him, throwing him into a momentary heart-stopping panic before they made a wide turn back. One hovered high overhead while the other dropped in smoothly just above the surface. Thomas leaped into the doorway, and they pulled him aboard. It was 1 a.m., and he'd been out there going on four days.

The final push

It wasn't until the end of Thomas's ordeal that Børge realized the gravity of the situation, when messages started coming in to his sat phone from three different people. "Please call Thomas!" Then, finally: "Rescue completed."

At this point, Børge and Mike were heading steadily north with the wind behind them, in the midst of a cold snap that dropped temperatures to minus 40°. Their faces were so encased in ice that it was hard to find a place during breaks to put the food in, and they couldn't take their mitts off to eat without freezing their fingers. For a time, they were walking along a long lead, in whiteout conditions, thinking about making a last run for the Pole. If they skied 12 hours a day instead of 10, they figured they might be able to complete the journey before the midnight sun arrived.

After a few days they realized that they could not walk for so many hours on only six hours of sleep when the weather was fighting them, and they decided to fall back to ten hours a day, with the aim now of arriving, as Børge put it, "in a dignified manner."

It isn't a desire to be closer to death that attracts them—it's a **desire to be closer to life.**

One last test

Around this time, Mike started noticing that 30 minutes of walking was feeling like two hours and that the sleds seemed heavier instead of lighter. He started to shiver, had trouble eating, and blood was oozing from his mouth and nose. Here was a guy who never complained, "the toughest guy" Børge says he ever met, and suddenly he was complaining—of back pains, kidney pains, bleeding when he went to the bathroom. Generally, Mike thought, people stopped themselves too soon, but he realized that you had to stop in time. Børge asked him if he thought he should give up. Mike said:

"I'm never going to give up."

They deduced that infection from various wounds and frostbites—pus came out under the nails when Mike squeezed his thumbs—had spread to his whole body. But Mike wouldn't take the antibiotics Børge had with him. He hated pills; the vasodilators he was on to thin his blood so his fingers wouldn't freeze were bad enough.

Børge, meanwhile, was having visions of Mike in a coma. He called a doctor in Norway, who told him it didn't sound good, and where was the nearest helicopter? (Victor was already looking into having a paramedic skydiver swoop in if Mike got worse.) Finally, Mike agreed to take the antibiotics—a double dose three times a day.

In the midst of all this, word came from Hans that a storm was brewing, and they had to get to the Pole before it hit. So they decided to make a run—within limits. Børge took over lugging the tent and doing more of the routines and suggested that Mike lead to set the pace, though leading is very tiring—making the track, concentrating on the route. Mike didn't want to appear weak, so he didn't say anything. He needed rest, but just days from the Pole, where they would be picked up by helicopter, he couldn't bring himself to ask for it, and if Børge offered, he would have to refuse. So he continued, walking like a robot, stopping along the way to hang on his ski poles.

"Børge, does the snow look pink to you too?"

"Mike, I think we better camp."

"No, no, we'll walk the day, we'll walk the day."

And so they did, the full ten hours every day, 15 miles a day at the end, as the antibiotics kicked in and Mike's strength began to return.

Two days or so before they expected to reach the Pole, the sun rose in a red glare over the horizon. It was March 20: Spring had arrived. It would have been nice to get there before that and officially nail the first ever trek to the North Pole to begin and end entirely in winter. They missed that record by a hair. But what they did accomplish stands as one of the most daring polar feats in recent memory: Setting out in total darkness. Navigating off Cape Arkticheskiy, swimming and skiing through that mess. Surviving physically and mentally. That was the essence of the trip. Mike overcoming his sickness. Børge breaking both skis and having to create a new pair with what he had. Two high-octane guys from different cultures, sharing a vision and becoming a team. Reaching the Pole was a necessary but oddly irrelevant conclusion.

Børge checked his GPS. It was Thursday, March 23, 2006. The Pole was a thousand yards away.

"I've been there before," Børge told Mike. "You've never been. You go first."

"No, no, no," Mike said. "We do it together."

In the end, the odd couple approached their destination side by side, banged up and frostbitten but still in one piece. Out there in the elements, the fundamental truths had emerged: The most important things in life really are family, friends, honesty, beauty, and love, and the journey really does matter more than the destination—lessons human beings can evidently learn over and over and never tire of. □

Long Cold Night What's worse than the rigors of a Polar trek? Facing death alone in the dark. See the images in our Photo Gallery at **ngm.com/0701.**

Flying the banners of Norway and South Africa, Børge, left, and Mike embrace at the Pole, fulfilling their dream to trek the Arctic Ocean during its most demanding season.

MIKE HORN

A River's Gifts

For more than 9,000 years soldiers and villagers have cast their treasures into a hallowed Slovenian stream. One archaeologist wants to know why.

ROMAN OFFICER'S IRON SWORD WITH BRASS AND COPPER SCABBARD • 27 B.C.–A.D. 14 • PHOTOGRAPH BY TOMAŽ LAUKO, NATIONAL MUSEUM OF SLOVENIA

Shrouded in mist and mystery, the Ljubljanica River has preserved thousands of prized objects such as a centurion's sword (left) from the Augustan era.

"Somehow people knew that the river was sacred.

By Carol Kaufmann NATIONAL GEOGRAPHIC STAFF
Photographs by Arne Hodalič

Archaeologist Andrej Gaspari is haunted by pieces of the past. His hometown river, the Ljubljanica, has yielded thousands of them—Celtic coins, Roman luxuries, medieval swords—all from a shallow 12-mile stretch. Those who lived near and traveled along the stream that winds through Slovenia's capital of Ljubljana considered it sacred, Gaspari believes. That would explain why generations of Celts, Romans, and earlier inhabitants offered treasures—far too many to be accidental—to the river during rites of passage, in mourning, or as thanksgiving for battles won.

But Gaspari may never be able to explain for certain why the Ljubljanica holds one of Europe's richest stores of river treasures, many of them remarkably preserved by the soft sediments and gentle waters. Too many pieces of the puzzle have already disappeared.

During the past two decades, sport divers have made the river their playground, removing most of some 10,000 to 13,000 objects found so far. Even though removing artifacts from the Ljubljanica has long been illegal, professional archaeologists have been forced to compete with private collectors. Some divers sold their loot to museums; others to the highest bidder. Some kept their treasures private. Many artifacts have left the country, untraceable. Gaspari's greatest torment comes from the knowledge that few maverick collectors know—or care—where exactly their prizes were found. For an archaeologist, an object's meaning comes as much from its context—location, association with other objects—as from the prize itself. Without context, there is no story.

Mladen Mück is one of Gaspari's tormentors. Now in his 40s, the Bosnian-born architect began diving in the river in 1985 and has brought up about a thousand pieces. In his kitchen in Ljubljana, a plastic box contains prehistoric tools. Upstairs, dusty cases hold other rare artifacts, including deer antler axes. Mück says he has no intention of selling what he has found. Like many collectors, he babies his goods and claims they are better off with him than with the authorities.

"More people see these artifacts in my house

Locations of Bronze Age, Iron Age, and Roman artifacts identified by Andrej Gaspari

BRONZE SWORD • 13–12TH CENTURY B.C.

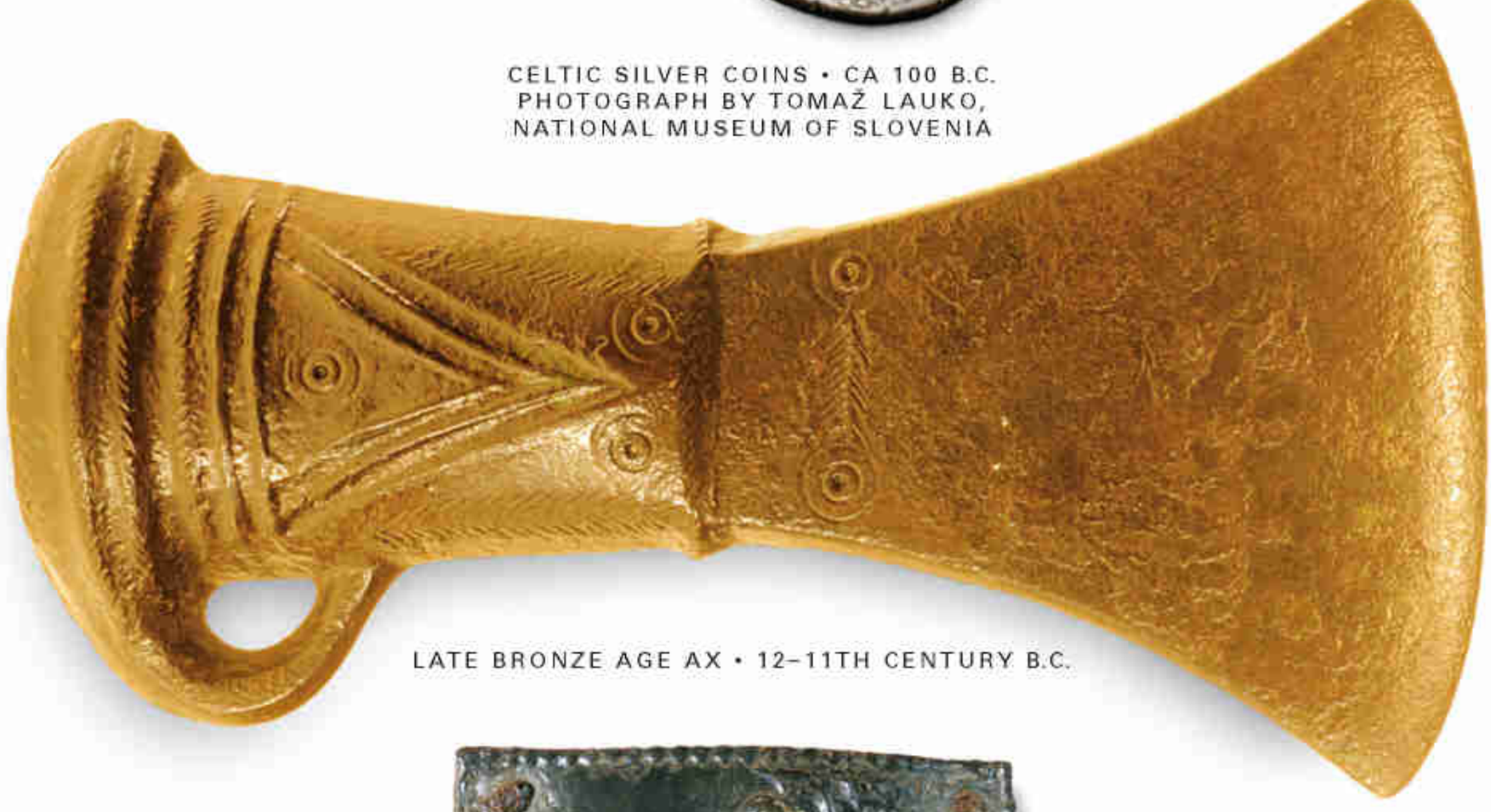
We should preserve and honor that." —Andrej Gaspari

BONE HARPOON • CA 3600 B.C.

On a Mission

An untold number of the Ljubljanica River's gifts have ended up in private hands—and Andrej Gaspari (above) wants them back. "These are Slovenia's," he says. "We shouldn't have to buy them from collectors." An underwater archaeologist at the University of Primorska, Gaspari has devoted his career to studying priceless artifacts such as a 3,000-year-old bronze sword (above and below) that were deposited in a 12-mile stretch of the river (map) by groups unknown to each other and often separated by centuries. A six-inch fishing harpoon (top) may have been abandoned near a river settlement some 5,500 years ago.

CELTIC SILVER COINS • CA 100 B.C.
PHOTOGRAPH BY TOMAŽ LAUKO,
NATIONAL MUSEUM OF SLOVENIA



LATE BRONZE AGE AX • 12–11TH CENTURY B.C.

ROMAN BELT DECORATION • 27 B.C.–A.D. 14

Lost and Found

While playing near the Ljubljanica in 1981, an eight-year-old boy discovered more than 50 large and rare silver Celtic coins (similar to the ones at top) and skipped them across the water. News spread fast; sport divers flocked to the river, found the coins—and much more. Since then, following the lead of archaeologist Peter Petru, amateur and professional archaeologists have brought some 5,000 artifacts from the river to the National Museum of Slovenia, including a scabbard clasp and clothing fasteners, precursors of buttons and zippers, from the Iron Age to the Roman Empire (right). Some artifacts still reside in private hands: A socketed ax (above middle) appears like new, evidence it was deposited as a votive offering. A military decoration (above) adorned with Minerva, goddess of war, was likely worn by a high-ranking officer in Rome's Augustan era. Catching and prosecuting looters of historic artifacts in Slovenia can be difficult, but in 2003 the national parliament declared the Ljubljanica River a site of cultural importance and banned diving in it without a permit.

SCABBARD CLASP AND CLOTHING FASTENERS • 650 B.C.–A.D. 50 (RIGHT)

CLAY FURNACE TILE • CA 16TH CENTURY

IRON SPEARHEAD • 13–14TH CENTURY

than if I gave them to a museum," he says with a dismissive wave. "There they would sit in a basement."

Gaspari disagrees. A team at the National Museum of Slovenia is preparing an exhibit of the river's treasures that will tour Europe in 2008, he says. Still, he hopes that someday Mück will hand over his items. "My heart is strong," quips the 33-year-old archaeologist. If Mück is obstinate, "I will outlive him."

As for artifacts still in the Ljubljanica, Gaspari believes they should be left untouched until they can be properly conserved. He searches for new objects only when he believes they are threatened—as is the case on one blistering July afternoon. Struggling into a wet suit on the riverbank, Gaspari gets ready for a dive. Water visibility is unusually good, he says, though you might not think so looking at all the algae and bits of trash.

He and his team have been hired by the town of Vrhnika to search for artifacts that could be lost when a sewage plant is built on the river. The need for a treatment plant is obvious from the stench of sulfur, and worse.

Gaspari doesn't expect to find much here, perhaps some medieval potsherds, not rare in an Old World river. But less than an hour after the divers begin their survey, one member of his team, Miran Erič-Pac, surfaces and hands him an ax made from deer antlers more than 5,000 years ago.

"We've never found an artifact so old this far upstream," Gaspari says. "It's probably from a nearby prehistoric settlement."

Then from the murk comes a 16th-century water pitcher painted with an aqua bird and yellow flowers that resembles a thousand replicas in local souvenir shops. Another diver hands him a chunk of stone with a decorative edge—a fragment of an ancient plate. Gaspari strokes its flat side, as familiar with its shape as with his morning coffee cup. "It's early Roman," he says, "around 10 B.C."

Throughout the day, more pieces of Slovenia's early story are found. Like other objects from the riverbed, they hint at a mysterious connection between distant generations and waters they revered. Somewhere, perhaps in the trove of artifacts in private hands—or perhaps in the river's murky depths—is the clue that could unlock the mystery. □

Precious Offerings See more treasures from the Ljubljanica in our Photo Gallery at **ngm.com/0701**.

Time Capsule

The river's gifts span the centuries—from an iron spearhead forged in the Middle Ages (above) to a handcrafted tile from a Renaissance furnace (left) to a pistol fired in the 17th century (below). Yet divers have recovered only a fraction of what the river has preserved.

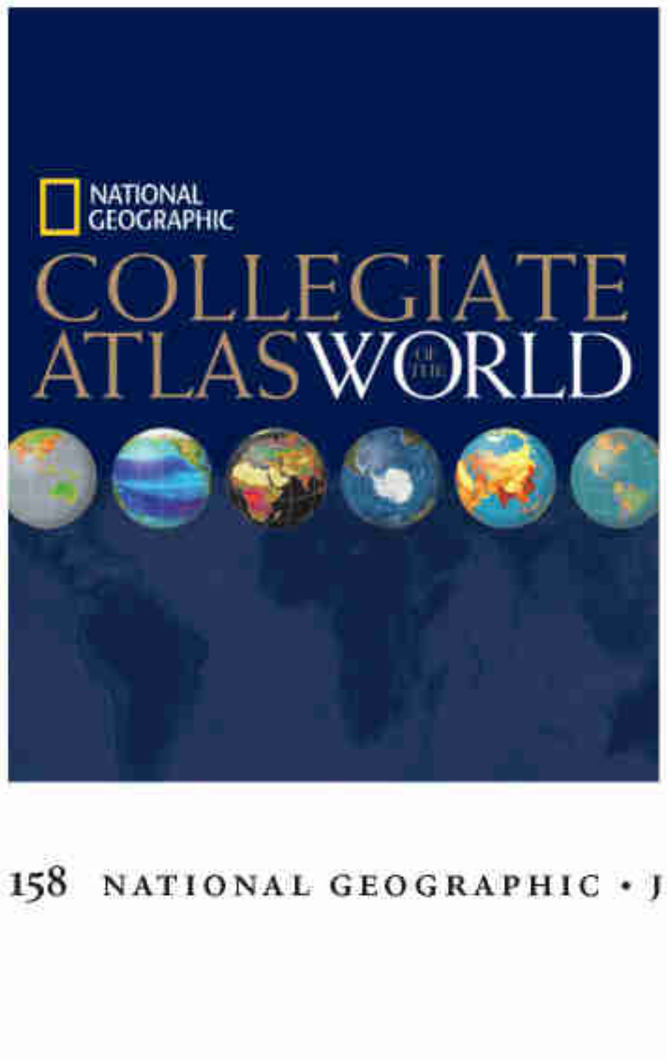
WHEEL-LOCK PISTOL • EARLY 17TH CENTURY

NG ATLAS

Changing the World

Last May the citizens of Montenegro anxiously awaited the outcome of their country's vote for independence from its union with Serbia. In Washington, D.C., the staff of National Geographic Maps waited too. It was almost time to send the *National Geographic Collegiate Atlas of the World* to the printer, and a new country would mean last-minute edits. In just two years, more than 600 changes (including two new national capitals, two international boundary modifications, and a new international airport) have been made to the names, borders, and features that define the world. The Society's mapping committee tracked every one—including Montenegro's.

While National Geographic cartographers kept up with some changes using pen on paper (right), the atlas was created from a state-of-the-art seamless cartographic database, which allowed them to map countries in various scales and projections. The atlas, which contains an unprecedented 90 pages of thematic maps, is available at bookstores now ($39.95).



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INSIDE GEOGRAPHIC

Photographer Luis Mazariegos focuses on a flower—his enticement for hummingbirds—before letting a bird loose inside his mobile studio.

ON ASSIGNMENT

Tiny Bird, Big Effort

Luis Mazariegos is a man on a mission. The founder of the Hummingbird Conservancy wants to photograph every known species—some 330 in all—of hummingbird. He's developed a unique way to take the pictures. First he nets a hummingbird, then releases it into the mobile photo studio (left) where he has placed a nectar-rich flower. "The bird starts salivating," he says. Mazariegos can make about four photos in the ten seconds the animal takes to feed. He may reach his goal soon. He has already captured images of 200 hummingbird species.

January Contributors

VOICES: JOHN DAU, page 32

Karen Kostyal edits the GEOGRAPHIC's "Voices" section. Her interview with Egyptian author Alaa Al Aswany ran in the September 2006 issue.

LAST OF THE AMAZON, page 40

A contributing editor to *National Geographic Adventure,* **Scott Wallace** began his journalism career in El Salvador in 1983.

Photographer **Alex Webb**'s book *Istanbul: City of a Hundred Names* will be published this spring.

WHAT ARE THEY DOING DOWN THERE? page 72

Douglas H. Chadwick's latest book is *The Grandest of Lives: Eye to Eye With Whales.*

Flip Nicklin has been photographing whales and dolphins for 29 years.

SUDDEN CITY, page 94

Formerly a Dubai-based correspondent for Reuters, **Afshin Molavi** is a fellow at the New America Foundation.

Maggie Steber has won a score of photography awards. Her last story for the GEOGRAPHIC was "War Letters" in November 2005.

FLIGHT OF FANCY, page 114

Writer **Michael Klesius** has always been fascinated by anything that flies. His story on the future of aviation appeared in the December 2003 NATIONAL GEOGRAPHIC.

When he is not chasing down hummingbirds, photographer **Luis A. Mazariegos** runs a biopesticide company and markets vaccines for a Colombian firm.

ARCTIC DREAMS AND NIGHTMARES, page 130

Marguerite Del Giudice is a former staff writer for the *Philadelphia Inquirer* and *Boston Globe.* This is her first feature for the magazine.

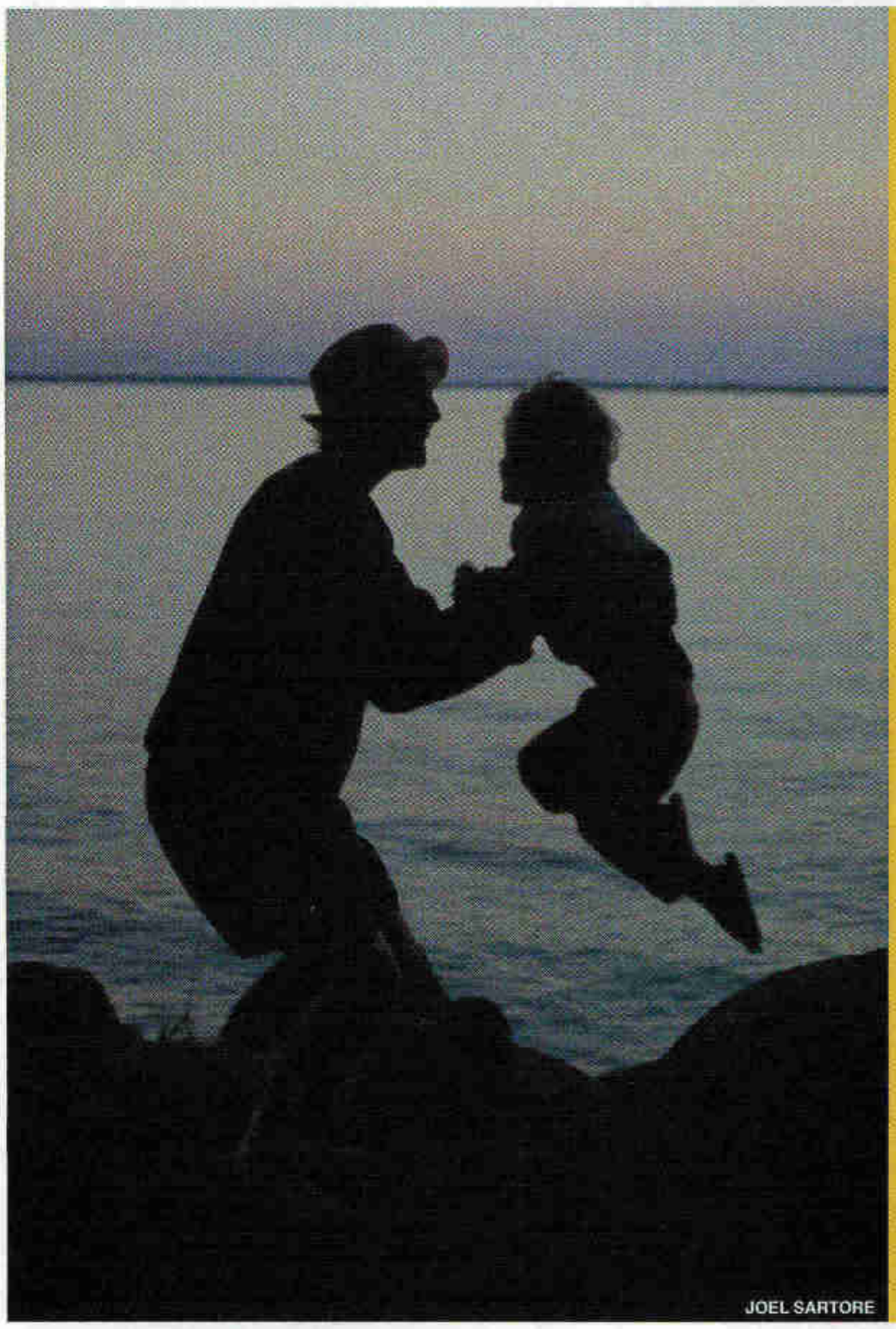
A RIVER'S GIFTS, page 150

Carol Kaufmann donned a wet suit to explore and write about Slovenia's treasure-filled—but chilly—Ljubljanica River.

Ljubljana resident **Arne Hodalič** is NGM Slovenia's photo editor and a photographer specializing in underwater work and cave diving.

Tales From the Field Learn more about our contributors in Features at **ngm.com/0701.**

PHOTO: JOSÉ JUAN PAMPLONA



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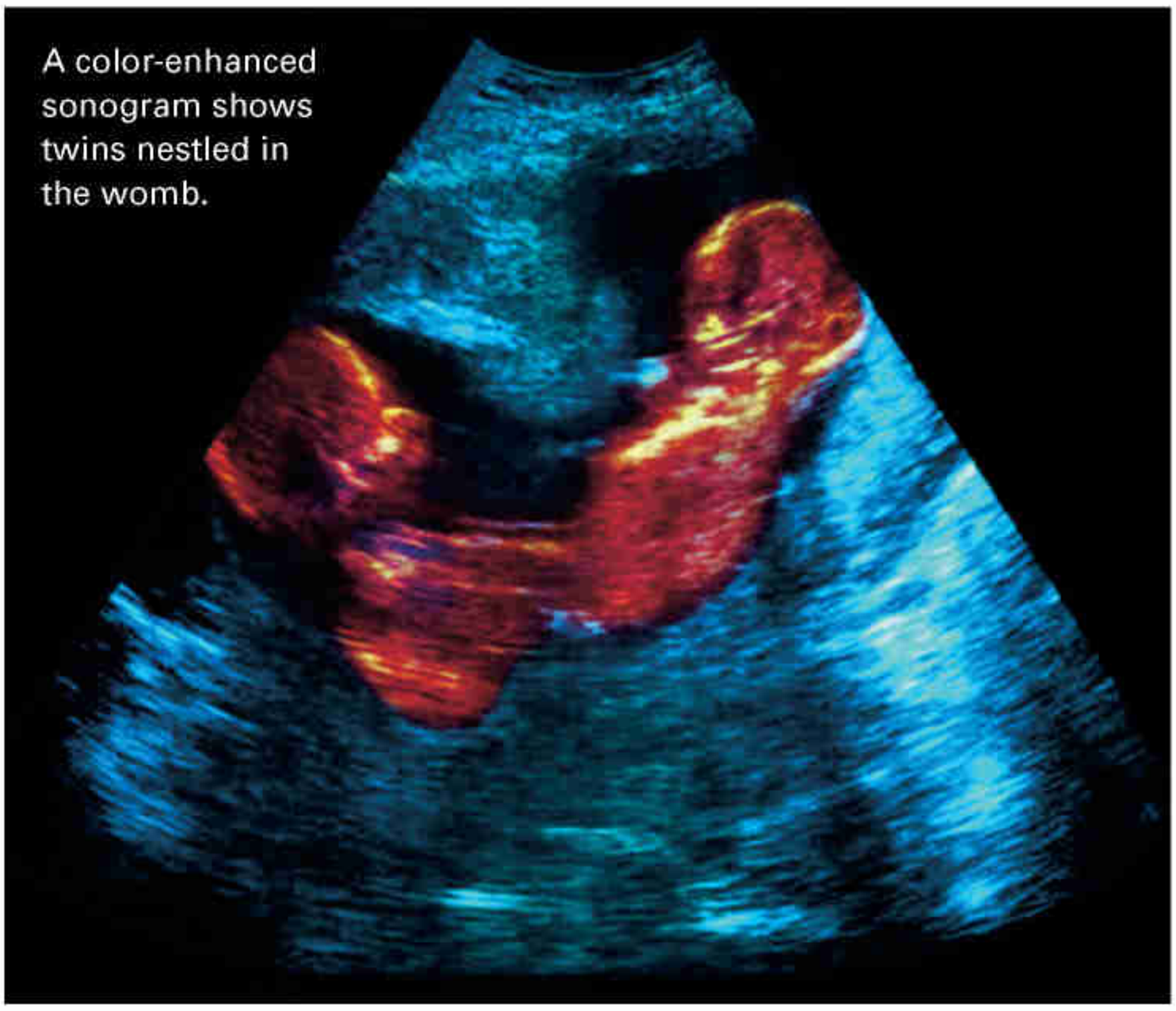
INSIDE GEOGRAPHIC



A color-enhanced sonogram shows twins nestled in the womb.

NATIONAL GEOGRAPHIC CHANNEL

In the Womb: Multiples

This month on National Geographic Channel: What really happens inside the womb as multiple fetuses mature? *In the Womb: Multiples* uses revolutionary imaging techniques to show how fertilized eggs grow into kicking, crying babies. Watch the program to see fetuses interact—touching and jostling.

ON ASSIGNMENT **For the Love of Whales** "I wanted to be the guy finding things out rather than the guy covering other people finding things out," says photographer Flip Nicklin. So after shooting 18 stories for the GEOGRAPHIC, Nicklin left journalism to study one of his favorite subjects—the humpback whale. In 2001 he founded Whale Trust with biologists Jim Darling and Meagan Jones. Now he researches the mammals' social groups and behavioral patterns and provides photographic IDs of the animals. This month's humpback whales article is the first that Nicklin, who donated his story fee to the group, worked on primarily as a researcher. "Flip is an ambassador for whales and for researchers," says Jones. "He's a model for what can happen. We're trying to inspire change, and he embodies that." To learn more, go to *whaletrust.org.*

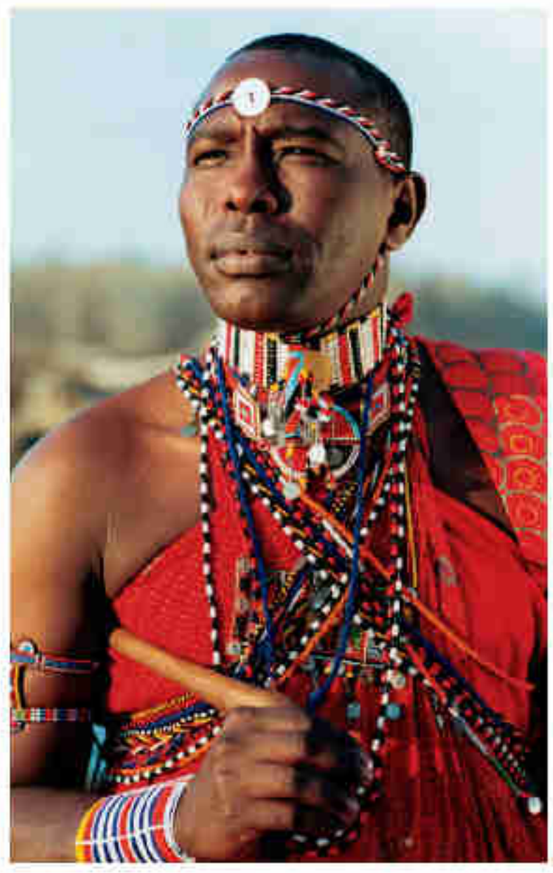
NG Spotlight

Joseph Lekuton: NG Emerging Explorer

After graduating from college, Joseph Lekuton got a job teaching in a suburban Virginia high school. But Lekuton is no typical American educator. The Kenyan is a Maasai tribesman whose family lived in a dung hut, and who grew up walking 20 to 30 miles a day to herd cattle.

Lekuton recognized that education meant opportunity. He created a plan to pay school fees for Kenyan youth, and he welcomed American students to his home village to promote cross-cultural awareness. In 2006, National Geographic named him an emerging explorer for his work, which includes a program to bring water to his country's dry regions.

Still, Lekuton dreamed of making a difference on a larger scale. Last July he came a step closer when he was elected to Kenya's Parliament. To learn more about Lekuton's childhood, read his book, *Facing the Lion: Growing Up Maasai on the African Savanna.*



PHOTOS (CLOCKWISE FROM TOP): UHB TRUST/GETTY IMAGES; ADELE STARR; JOSEPH S. STANCAMPIANO

If You Purchased Paxil® or Paxil CR™ for Someone Under the Age of 18

A Proposed Class Action Settlement May Affect Your Rights

There is a Proposed Settlement in a class action lawsuit, *Hoormann v. SmithKline Beecham*, Case No. 04-L-715, in the Third Judicial Circuit for the State of Illinois.

The Proposed Settlement affects a "Class" or group of people that may include you. This Notice is just a summary. For more complete information, you should read the full Notice. You can get a copy of the full Notice by calling the toll-free number or visiting the Web site listed below.

What is the Class Action Lawsuit About?

This lawsuit claims that GlaxoSmithKline ("GSK") promoted Paxil® and Paxil CR™ for prescription to children and adolescents under eighteen. It also claims that GSK withheld and concealed information about the medication's safety and effectiveness. GSK denies all the claims.

Who is Involved?

The Class includes all persons in the United States who purchased Paxil® or Paxil CR™ prescribed for consumption by a minor child.

What Are the Terms of the Settlement?

A $63.8 million fund will be established. The fund will be used to pay consumers, who submit valid Claim Forms, cash for the total amount they paid for Paxil® or Paxil CR™. Class Members can get up to 100% of the amount paid for Paxil® or Paxil CR™.

Attorneys' fees, expenses, payments to Class Representatives and the costs of providing notice and administering the Proposed Settlement will be deducted from the fund.

Who Represents Me?

The Court has appointed law firms, Korein Tillery and Swedlow & Associates, to represent the Class. Class Counsel will request that the Court award attorneys' fees and expenses in an amount not to exceed 26% of the Proposed Settlement fund. You may hire your own attorney, if you wish. However, you will be responsible for your attorney's fees and expenses.

What Are My Legal Rights?

- If you wish to remain in the Settlement Class, you do not have to do anything. You will be bound by all the Court's Orders and will release all claims against GSK related to the claims in this lawsuit.

- If you wish to file a claim, you must complete a Claim Form. You can get a Claim Form by visiting the Web site www.PaxilPediatricSettlement.com or by calling 1-866-494-8404. Claim Forms must be signed and received by **August 31, 2007**.

- If you wish to exclude yourself from the Proposed Settlement, you must sign a written request to be excluded as outlined in the *Notice of Proposed Class Action Settlement*. Your request must be received by **February 23, 2007**.

- If you or your attorney wish to object to or comment on the Proposed Settlement, you must send a written objection as outlined in the *Notice of Proposed Class Action Settlement*. Your request must be received by **February 23, 2007**.

When will the Court Consider the Proposed Settlement?

The Court will hold a Final Approval Hearing on **March 9, 2007** at 10:00 a.m. to consider whether the Proposed Settlement is fair, reasonable, and adequate and the motion for attorneys' fees and expenses. If comments or objections have been received, the Court will consider them at this time.

For more information (también en español) and a copy of the *Notice of Proposed Class Action Settlement*,

Call: 1-866-494-8404 Visit: www.PaxilPediatricSettlement.com

Or Write: Settlement Administrator, P.O. Box 555, Minneapolis, MN 55440-0555

FLASHBACK

On Top of the World Cmdr. Robert E. Peary scans the horizon near his igloo at Camp Jesup near the North Pole in April 1909. After staking his claim as the first person to reach the Pole, he wrote, "when I knew for a certainty that we had reached the goal, there was not a thing in the world I wanted but sleep." Before breaking camp the next afternoon, he found time to pen a postcard to his wife: "My dear Jo, I have won out at last. Have been here a day. I start for home and you in an hour. Love to the 'kidsies.'" *—Margaret G. Zackowitz*

Flashback Archive All the photos plus e-greetings, in Fun Stuff at **ngm.com/0701.**

PHOTO: ADM. ROBERT E. PEARY COLLECTION

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